McGraw-Hill Publishing Company

November, 1927

Thirty-five Cents per Copy

CHEMICAL ENGINEERING

Volume 34 *Number 11*

CHEMICAL & METALLURGICAL ENGINEERING

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Chemical & Metallurgical Engineering is the successor to *Metallurgical & Chemical Engineering*, which, in turn, was a consolidation of *Electrochemical & Metallurgical Industry* and *Iron & Steel Magazine*. The magazine was originally founded as *Electrochemical Industry*.

Contents, November, 1927

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Avenue at 36th Street, NEW YORK, N. Y.

New York District Office, 285 Madison Avenue
Cable Address: "Machinist, N. Y."

Number of Copies Printed This Issue, 12,400

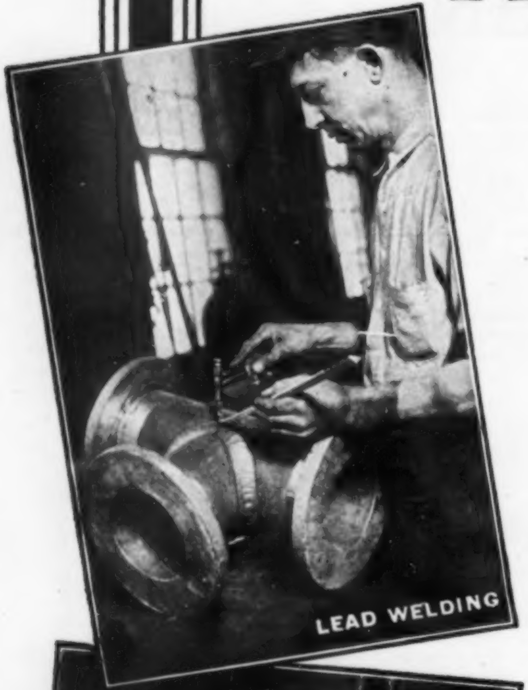
The annual subscription rate is $3 in the United States, Canada, Mexico, Alaska, Hawaii, the Philippines, Porto Rico, Canal Zone, Cuba, Honduras, Nicaragua, Dominican Republic, Salvador, Peru, Colombia, Bolivia, Ecuador, Argentina, Panama, Brazil, Uruguay, Costa Rica, Guatemala, Paraguay, Chile, Haiti and Spain. Extra foreign postage in other countries $2 (total, $5, or 21 shillings). Single copy 35c. Change of address—When change of address is ordered the *new* and the *old* address must be given. Notice must be received at least ten days before change takes place.

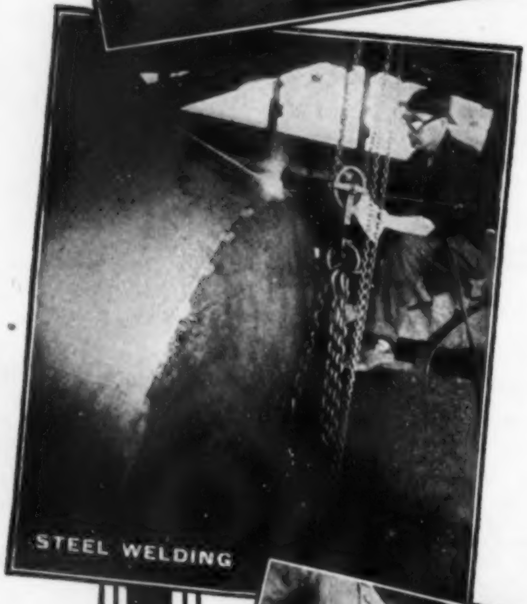
Published monthly. Entered as second-class matter July 13, 1918, at the Post Office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A.

Member Associated Business Papers, Inc.

Searchlight Section, 208-214; Professional Directory, 206-207; Ready Reference, 230-232-234-236; Alphabetical Index, 238

Acetylene—
the universal gas


LEAD WELDING


STEEL WELDING

OCCASIONALLY one hears of a gas other than acetylene that can be used with oxygen for cutting steel.

The promoters of such gases readily admit that acetylene is the best for all other uses with oxygen.

That's why acetylene can be called the universal gas for all oxy-acetylene welding and cutting. It can be used equally well for welding thick or thin plates of metal. It is the most satisfactory for cutting steel or cast iron, and also for brazing, welding and soldering.

In fact, the very term—*oxy-acetylene* process—itself is a good indication of the fact that acetylene is the "universal" gas.

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CHEMICAL & METALLURGICAL ENGINEERING

H. C. Parmelee
Editor

Volume 34 New York, November, 1927 Number 11

A Challenge to American Brains

COMPETITION for world trade, foreshadowed as a coming event shortly after the World War, begins to loom as a reality. International understandings are rife among the industries of the Old World. Looking to their own rehabilitation, the industrial leaders of Europe are combining in a form of trade organization unknown in this country and impossible under our laws. Concretely, the international cartel is taking shape abroad as a means of offense and defense in trade. As a measure of self defense the cartel seeks to unify its members by avoiding destructive competition for such business as is obtainable. Offensively it is designed to present a solid front against competitors in world markets.

CHIEF among the foreign cartels, and of deep significance to the United States, is the international chemical trust in which the I.G. of Germany, I.C.I. of England and Kuhlmann of France are said to be participants. Reports of an industrial accord among these organizations were announced in *Chem. & Met.* months ago and rumors to the same effect have long been current. Co-ordination of research, pooling of knowledge and experience, consolidation of small units, elimination of waste, reduction of cost, allocation of production and markets are among the advantages hailed by advocates of the cartel.

ALL this is a challenge to American technical brains and business ability. We have no control over the methods of organization or trade agreements of foreign industrialists, but we know beyond a doubt the general course to pursue in meeting this new form of foreign competition. We cannot set up monopolistic organizations, but we can reduce costs through better management and elimination of waste. We cannot allocate production and markets, but we can redouble our efforts in scientific and industrial research. We cannot make price fixing agreements, but we can pursue still further our studies in marketing methods. In short we can and must acquire a greater appreciation of what Dr. Klein calls the "economy of knowledge" in business.

THERE has been a general assumption that the European cartel movement is specially directed against American commerce. It is doubtful if this is the case. More probably the primary motive of European industrialists is to use the cartel to build up their own trade wherever it can be found. It is one of their weapons against our advantage of mass production. Undoubtedly it means increased competition for American exports, but as far as the chemical industry is concerned exports are not a major factor in our markets. True, we need export outlets for some commodities, and should use every legitimate business and technical means to hold them. The "economy of knowledge" will point the way.

MODIFICATION of the Sherman law has been suggested as a business aid in this new situation, but thus far no proposal has taken definite form. The idea, however, has found favor in industries other than the chemical and has been suggested as an economic measure in the petroleum and metal mining industries. It is felt that something more is necessary than the right to organize for export trade under the Webb-Pomerene act. Lacking new legislation, however, the way out lies in better management, precise economic knowledge, more research and improved marketing methods.

Internal Competition for the Nitrogen Syndicate

DEFINITE details of the organization and policies of the European chemical combine are still lacking but apparently the well-laid international plans of the I.G. are gradually materializing. At such a time it is interesting to learn that in Germany itself there has been at least an interruption in the program for world dominance.

The German coal-mining industry, threatened with the loss of its byproduct ammonia market through the synthetic nitrogen and fertilizer program of the dye trust, developed the independent Mont-Cenis fixation process operated by the Steinkohlenwerkschaft Mont-Cenis in Solingen, Westphalia. Little is known of the process except that it operates at pressures under 100 atmospheres, with temperatures around 400 deg. C. and, furthermore, that the hydrogen is recovered from coke-oven gases—a very economical source. Taking cognizance of this development, the I.G. brought suit some time ago to protect certain of the Haber-Bosch catalyst patents from alleged infringement by Mont-Cenis. Now we learn, from reliable sources abroad, that a decision has been rendered in the Westphalian supreme court in favor of the independent process.

The German court decision that Mont-Cenis has not infringed the Badische catalyst patents would seem to be of principal significance because it gives the German coal industry its chance to break into the new field of synthetic fertilizer materials. Working with the closely allied potash combine, it should be possible to produce the new concentrated mixtures such as Nitrophoska, which have attracted international attention. The suit does not mean that the Haber patents are thrown open for unrestricted use in Germany and certainly not in this country where even more basic patents are held by the Chemical Foundation. It does mean, however, that trouble is brewing in the German nitrogen industry and, barring further consolidations, internal competition may help to break down the stronghold of the German nitrogen syndicate.

The Sherman Law and Export Trade

TENDENCIES abroad toward the extension of the cartel system to the proportions of a "chemical trust," international in scope, has provoked the counter proposal that the Sherman anti-trust law should be amended to provide for American industry an equitable basis for competition. It is argued that America will be no more able to compete in the world market than an independent producer was able to compete in the national market of the United States before the passage of the Sherman law thirty years ago.

That the issue thus raised transcends in significance the mere political pros and cons was effectively emphasized by William J. Donovan, Assistant to the Attorney General, addressing the annual convention of the National Paint, Oil and Varnish Association in Atlantic City on October 28. Mr. Donovan sees two diametrically opposed trade theories thrown into sharp relief: the continental theory that industrial combination involving legalized monopoly is economically desirable, and our theory based on the idea of equal opportunity, individual initiative and freedom from governmental regulation. Where the cartel system is designed to control artificially the operation of economic law by price fixing and restraint of trade, we maintain machinery for the preservation of genuine competition. In fact, the principle of competition, permeating as it does our whole economic and political structure, has been embodied in our law "not as a rule of business conduct but as a philosophy of human relationship."

Mr. Donovan's exposition of the anti-trust laws and foreign trade is worth careful reading. He speaks out of a long experience in handling conflicts of industry with the Sherman law, and his views represent the sympathetic thought and policies of the Government. He neither asserts that the American policy is right, nor does he criticize the European. He points out that our legislation grew out of experience rather than theory.

It is not to be inferred that under the American plan all combinations in industry are to be condemned. Mere size is no criterion of evil intent or effect. It is only when the element of monopoly enters that our goverment prohibits consolidation. As long as combinations seek only to derive advantage from economical management, progress in mechanization and cost accounting, improved production methods, simplification of products, development of markets and similar legitimate functions that do not lead to dominance detrimental to the consumer, they represent a natural development and are necessary to industrial growth. Such consolidations may correct the evils of destructive competition.

The cartel, on the other hand, is organized to prevent the free play of economic forces as we conceive them. It is organized to allot production and markets, eliminate high-cost units and fix prices. Because monopolistic power and governmental participation are inevitable developments of the cartel system, conditions affecting commerce become matters of governmental concern with consequent menace to international good will. "The international cartel," says Mr. Donovan, "cannot exist until the domestic markets of the participating countries are sufficiently regulated to enable them to enter into an international agreement involving some form of control. So that domestic monopoly is implied in every international cartel that has any hope of being successful."

The advantage sought and claimed for the cartel is commercial stability. But the plan has its inherent weaknesses. As Mr. Donovan points out, "It leads to governmental participation in and control of business enterprises. So that, even abroad, where the cartel is functioning there is evidence of fear on the part of certain of its proponents that governmental participation originally looked to for reasons of protection may now expand in the direction of nationalization of resources." Again, the very size of the cartel and the number of its constituent units is a menace to its success. Members have to be kept in line and disintegrating forces are constantly at work.

It may be argued that the development of world consciousness in American industry has antiquated the Sherman law. Nevertheless, the roots of the competitive system in this country are not compassed by the statute books, and any attempt to modify that system must find social and economic as well as legal justification. The proposal to amend the Sherman law is not a simple one. Those who advocate it sincerely will doubtless find sympathetic advice in our government departments. Mr. Donovan, however, places great hope in the trade association as an instrument for commercial stability and security which, he says, cannot be attained by short cuts but must rest on economic and scientific principles.

Easy Money From Colloids

RENO, NEV., long noted for the dispatch and efficiency of its legal separation processes, appears to be the birthplace of a new and startling type of colloidal separation. And, judging from a brilliant prospectus, certain Reno promoters have a well laid scheme for the separation of funds from those who wish to be initiated into the colloidal mysteries of matter. Even the good name of Bancroft is made a part of this strange solicitation.

"Gasone," says this pamphlet of the Universal Products Corporation, is "the smallest and oldest unit of substance"—"the perfect fuel"—"the perfect colloid." It owes its origin to the discovery that "upon complete impregnation of liquids or near liquids with air under high pressure, then releasing the impregnated liquids or near liquids into a materially lower air pressure, the liquids or near liquids are broken into subdivisions so small as to be only about one one-hundred-and-forty billionth of an inch in diameter, discernible only by the use of highpower microscopes." That, however, is only half the story, for the little red booklet recounts the further discovery "that this unit would fall into molecules, or true gas if caused to separate one time more."

So much for the theory of Gasone since its real romance seems to lie in its universal application. When applied to oil ("anything from crude to high-proof gasoline, vegetable or animal"), water and air, Gasone becomes in turn the perfect fire-box fuel, the perfect gas-engine fuel, the perfect Diesel-engine fuel, or the perfect gas-producer fuel. Presumably this remarkable uniformity of perfection is due to the fact that "Gasoning breaks the oil and water into such minute units as to render it practically without fuel centers, thus obtaining instant, uniform and complete oxidization, producing four to four and one-half times the expansion obtainable without Gasoning." Lack of space here precludes further description of the remarkable performance of these "perfect" fuels.

The pamphlet comes closer to the chemical engineer's interest in its section on "Gasone, the Perfect Dehydration." Here, it seems, we reverse the process. "Any substance held in suspension or in the usual colloidal state . . . will separate and precipitate in dry form if properly projected into the proper kind of a chamber after the liquids or like liquids have been Gasoned." "This is invaluable," continues the report, "in the manufacture of sugar and many other world-wide used commodities which are taken from liquid form." Evaporators, centrifugals, filter presses, crystallizers, and spray dryers will become obsolete once the new Reno separation process comes into its own.

Then, too, there are wonderful Gasone emulsions "so finely divided that the Brownian movement is in full view in every single Gasone." Gasone milk, made of vegetable oil and fruit or vegetable juices with a "high content of vitimins" (sic) is far better than cows' milk because it is "absolutely chemically pure." Gasoned castor oil becomes as "desirable as a soda fountain confection" and "one teaspoonful is more effective than a large tablespoonful of the raw oil."

Any comment with which we might conclude this humble and faltering account of the great Reno discovery would indeed be an anticlimax. So we shall let the promoters make their final appeal in their own words: "Gasone will render a higher efficiency and a greater variety of service to commercial, domestic and individual life than any other thing known to man today. If you use heat, light or power, electricity or any one of over twelve hundred different colloids, Gasone will serve you best."

Textile Manufacturing as a Chemical Engineering Industry

"OPPORTUNITIES for Study and Research in Textile Engineering and Textile Chemistry," a bulletin describing certain courses given by the Massachusetts Institute of Technology, raises a question in our mind: Why not "Opportunities for Chemical Engineering in the Textile Industry?" Certainly an industry that is dependent upon chemical processing in many of its manufacturing operations and is itself the largest single consumer of dyes and chemicals cannot long continue to confine the chemist to the laboratory, while leaving to the mechanical or electrical engineer the full responsibility for the application of chemical principles and chemical engineering processes.

"There is a continually increasing demand in the textile industry," says the M. I. T. bulletin, "for technically trained men to handle problems of an advanced nature in relation to manufacturing processes, physical and chemical laboratory determinations, standardizations, acceptances and rejection of contracts and for original research." The demand also exists, although perhaps not as yet articulate, for men grounded in the fundamentals of such chemical engineering operations as liquid handling, mixing and agitation, evaporation and drying, dissolving and leaching and humidity control and air conditioning. Bleaching, dyeing, mercerizing and other textile finishing operations are combinations of these fundamental physical processes and are distinctly chemical because the reacting materials used are products of chemical industry. That such operations have always been on an empirical basis is all the more reason that they can be improved by the chemical engineer.

In the limited number of mills of which we have specific knowledge, the textile chemist is performing a valuable service. His analytical control saves money on purchases and sales and his check on production helps to maintain high-quality of product. Apparently, however, he is seldom allowed beyond the narrow confines of his laboratory. When a real plant problem arises, such as the provision of a new water-treatment process or a method of disposing of a bothersome trade waste, the management usually calls in an outside consultant or relies on the advice of the sales engineer of the equipment manufacturer. Such a solution for the problem is costly and not nearly as satisfactory as one worked out by the men on the job who are most familiar with it. By placing limitations on the textile chemist's activities, he cannot fulfill his most valuable functions.

Management in the textile industry is just beginning to realize that chemical principles extend beyond the test tubes and beakers and that chemical engineering has a part in practically every manufacturing operation. The industry appears to be going through a stage in the evolution that has already characterized the technical progress of the pulp and paper, petroleum, paint and varnish and other industries of the chemical engineering group. It is on the threshold of a promising development in its technology.

Chemical Engineering Contributes to Better Lighting

Inside frosting of incandescent lamp bulbs has resulted not only in better, but in cheaper light

By Marvin Pipkin
Incandescent Lamp Department
General Electric Company

LIKE SO many other chemical processes, the etching and frosting of glass is old in history, but young in technology. It has remained for the last few decades to see the process firmly established on a scientific basis; and for the last generation to see it develop into its present useful stage.

As will be later explained, frosting is a special case of the etching of glass. All etching is not necessarily frosting. The process applied to glass for the purpose of rendering it white and translucent, referred to as frosting, consists in the decomposition of the surface of the glass, with an attendant formation of crystals of the products of the decomposition on the glass surface. The result is that light which passes through the broken surface is diffused.

Frosting the outside of incandescent lamp bulbs has been resorted to for some time in spite of the inefficiency of the resulting product. Such bulbs were inferior to those of clear glass in their light-passing properties even when new, but in addition were difficult to keep clean and consequently became poorer with age. Efforts have been made for a number of years to apply the frosting to the inside of the bulbs and eliminate the accumulation of dirt on the bulb surface. These attempts have, however, only recently been successful because of mechanical difficulties. Not only was it a great deal more difficult to cause the reaction to take place inside the bulb, but, peculiarly enough, the bulbs which were made this way were much too fragile to withstand the further processing required in inserting the filament and sealing and exhausting the bulb.

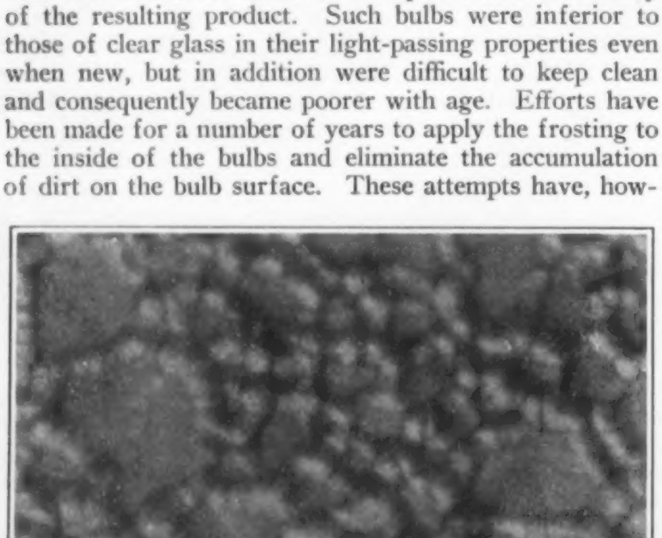


Fig. 1—Frosted glass surface before fortification. Magnification X 1035

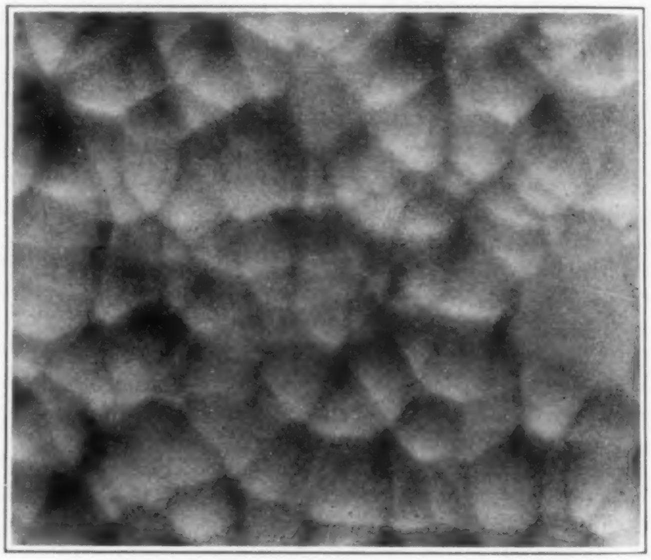


Fig. 2—Frosted glass surface after fortification. Magnification X 1035

Research, however, has shown a way to prevent this phenomenon, with the result that a bulb can now be produced which is practically as strong as one made of clear glass. The intensity of the light per unit of area from the new type of bulb increases only very slightly with the candle-power, and has only a small fraction of the intensity of a clear glass bulb. On the other hand, the frosting results in a very negligible diminution of the candle-power. In addition, it has been possible to reduce by 25 per cent the cost of bulbs to the consumer because it has been possible to standardize on but five lamp styles, instead of the forty-five previously found to be necessary.

A frosted, or as it is sometimes called, a matt etched surface, may be likened to a surface of water which is violently ruffled by a heavy wind. Due to the large number of diffraction surfaces presented, the surface is

white. Simple etched surfaces, however, are comparable to water disturbed by a light breeze. The slight ripples produced are not sufficient to whiten the surface. But here the analogy ends, for not all glasses react similarly. The harder a glass is, the more difficult it is to frost, although any glass can be frosted if the solution used contains sufficient hydrofluoric acid and sufficient dissolved fluorides derived from the glass. It is apparent that in addition to there being enough of the corrosive agent present, there must also be sufficient dissolved material so that the solution of the decomposition products of the glass will force the equilibrium in the direction of crystallization. On the other hand, for proper frosting it is not desirable to allow the crystallization to be complete. The optimum conditions call for rapid solution and a rapid partial crystallization of the products on the surface of the glass. As will appear, this result is accomplished by the repeated use of the same frosting solution with the addition of sufficient fresh solution to maintain the etching properties.

Fig. 1 shows a microphotograph of a matt etched surface. The reader's attention is particularly called to the numerous sharp edges and the jagged appearance of the glass. Fig. 2, however, presents a smoothly curved surface. Nevertheless, the second photograph shows the desired type of frosting. An examination of these two surfaces reveals the method which is employed to strengthen the frosted glass. It was found empirically that if a freshly etched surface were subjected for a short time to additional etching action using instead of the ordinary solution, containing a large amount of dissolved glass, a solution somewhat weak and far from its crystallizing point, that the objectionable fragility was lost. It appears that when the sharp corners and jagged surface are changed to continuous curves, that incipient cracks are averted, in the same manner that castings, for instance, are strengthened through the use of fillets. The discovery of this further treatment, now known as fortification, is the basis for the present use of inside frosted lamp bulbs and constitutes a very simple means of producing a much desired result.

While it is known that different kinds of glass require different frosting solutions, it is fortunately true that 90 per cent of all incandescent lamp bulbs are made of soda lime glass. As a consequence, much research has been necessary in looking for the most suitable solution for this purpose. When the exact nature of frosting as compared with etching became known, however, the problem assumed a simpler aspect.

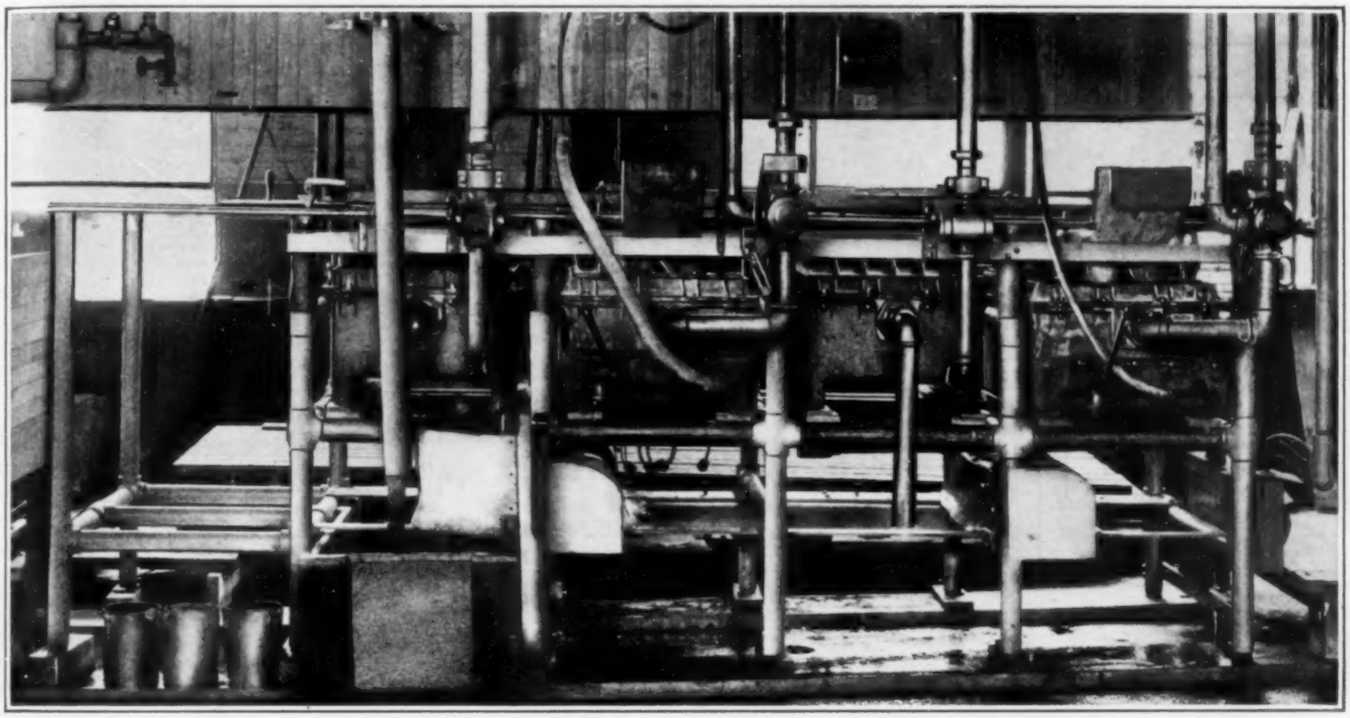


Fig. 3—Side view of the frosting machine used at the plant of the Pitney Glass Works

If a 60 to 70 per cent solution of hydrofluoric acid is saturated with crystals of ammonium bi-fluoride containing 31 to 33 per cent of hydrofluoric acid, the most efficient known etching agent results. To produce matt etching, however, it is necessary to cut down the acid strength by the addition to the acid of soda ash, powdered glass or other materials, to insure crystal formation. To conserve solution on the other hand, the same effect is obtained as mentioned above by replenishing the original solution with new, of the following formula which is now standard:

Hydrofluoric Acid (60 per cent)	37.3 per cent
Ammonium bi-fluoride (32-33 per cent HF)	29.0 per cent
Ammonium carbonate (28 per cent NH_3)	12.4 per cent
Soda ash	6.2 per cent
Water	15.1 per cent

About 6.8 per cent of the weight of the mixture is lost as CO_2, which leaves a solution analyzing as follows:

Hydrofluoric acid	27.0 per cent
NH_4F	29.0 per cent
NaF	6.3 per cent
H_2SiF_6	0.3 per cent or less
Water	37.4 per cent

This mixture is not used directly, but rather to keep the working solution up to an active ingredient content of

approximately 26.5 per cent hydrofluoric acid and 22.7 per cent H_2SiF_6. The working solution is kept indefinitely and "butted up" as may be required. The fortifying solution is made from the above mixture by the addition of three parts of water. This latter solution is discarded weekly since it loses its fortifying properties as the crystal-forming components build up.

As a result of this development, the frosting industry is now in a position to consume annually about one million lb. each of hydrofluoric acid and ammonium bifluoride. In addition, something less than one-quarter million lb. of ammonium carbonate and one-half million lb. of soda ash will be required to produce about 400 million lamp bulbs each year.

Figs. 3 to 6 show the frosting machine which has been worked out by the Lamp Development Laboratory of the General Electric Company, for use in the plant of the Pitney Glass Works. Fig. 3 shows a side view of the entire machine, while Fig. 4 represents the same aspect of the apparatus diagrammatically. Figs. 5 and 6 are, respectively, full front and angular views from the operating end.

A little examination will show, that despite its simplicity, the machine is very well adapted to the purpose for which it was designed. One operator is able to turn out about 63,000 bulbs, completely frosted, fortified, washed, and dried, in eight hours. The average production on all sizes of bulbs amounts to 125 per lb. of frosting mixture. Hot water consumption for washing purposes is 13 cu.ft. per 1,000 bulbs produced. It is obvious that the installation is economical.

In the last analysis, the machine consists simply of four cast bronze tanks equipped with sprays for distributing the wash water or solutions over the inner surfaces of the bulbs, funnels for catching and returning to the tanks the fluids leaving the bulbs, means for keeping the contents of the various tanks at the proper temperatures, and a suitable device for advancing the bulbs from one stage of the process to the next. The methods which have been employed in connection with these various functions are, however, sufficiently interesting to merit a considerably fuller description. It is entirely conceivable that some of the apparatus which was developed in this connection may also be applied in other parts of the chemical engineering field.

All parts of the machine which come in direct contact with any of the acids are made of bronze, or in a few cases, of brass. The untreated bulbs are placed, 54 bulbs per tray, in lacquered wooden trays which slide in brass tracks mounted above the tanks. With reference to Figs. 3 and 4, the bulbs are first placed by the operator on the track above the tank at the extreme right. After treatment at the first tank, the tray is advanced to the second and so on, until it finally emerges at the left, and passes into the drying chute. The tanks, in order of the flow of bulbs are: frosting tank; wash tank in which recovered water from the last tank is used; fortifying tank; and finally, wash tank where the last traces of acid are removed with fresh water. Warm water at a temperature of 60 deg. C. is supplied to the wash tank D through the pipe and valve indicated in Fig. 4. The overflow from this tank is collected in a sump from which it is pumped to an overhead tank for delivery to the first wash tank B. The overflow from B is first neutralized with lime and then discharged to the sewer. Frosting acid and fortifying solution are added when needed to tanks A and C respectively, by means of the large funnels plainly shown at the left in Figs. 5 and 6. The solutions in these tanks are maintained at about 57 deg. C. by means of strip heaters placed beneath the tanks. The wash tanks are not heated, as a supply of thermostatically controlled hot water is available.

Examination of Fig. 4 will show that the track which carries the bulb trays is capable of being raised or lowered. This is accomplished by means of an air cylinder, not shown, which operates push rods working through the legs of the machine, by means of a series of racks and gearing. Thus, the trays of bulbs may be lowered toward the small funnels above the tanks, or raised so that the necks of the bulbs will clear the spray-

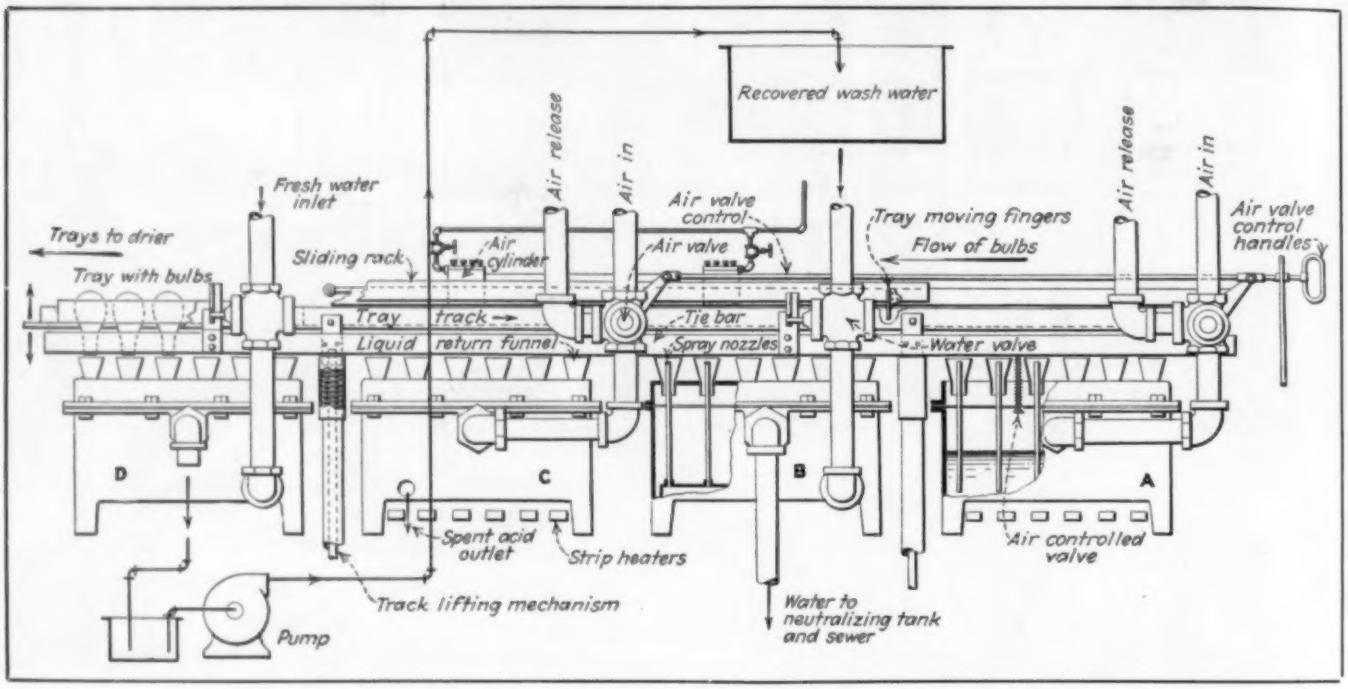


Fig. 4—Sketch showing in detail a side elevation of the frosting machine

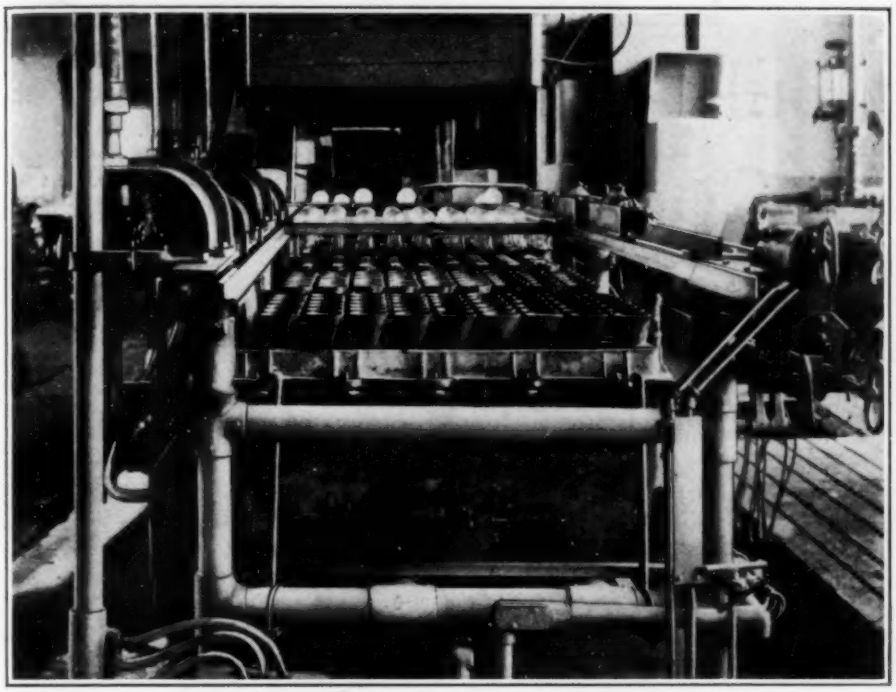


Fig. 5—View of the frosting machine from the operating end, looking toward the drying chute

ing mechanism. When the bulbs are in spraying position above any tank or tanks the fluids can be forced through the nozzles into the bulbs, by 1½ lb. air admitted above the solutions in frosting tank A and fortifying tank C; or by the pressure of the water in wash tanks B and D. Handles beside the operator control the valves admitting air to the acid tanks. The water valves, on the other hand, open automatically when a tray is lowered over either of the wash tanks. If it should so happen that there is no tray over one of these tanks when the track is lowered, the water valve moving mechanism is not tripped and no water is lost.

To accomplish the advancement of the trays through the machine so that the bulbs may receive the four successive steps of the process, another air cylinder is provided, as indicated on Fig. 4 and shown at the right on Fig. 6. This cylinder, by means of its piston rod, moves a rack back and forth a distance equal to the amount of movement required in displacing a tray from its position above one tank to the next in line. The rack carries four dogs or fingers which engage lugs at the back of the four trays in the machine, provided the trays are in the raised position. By operating the proper valves from his platform, the operator is able to advance all four trays simultaneously to the next position. When he has lowered the trays so that the necks of the bulbs extend into the spraying funnels, he can then return the rack to its former position, ready for the next advancement.

The operation of the machine is very simple. When any tray of bulbs has passed over the four tanks, it is pushed off onto the track leading to the drying chute. This completes the entire cycle for that tray. Previously, a large rack containing a number of trays of untreated bulbs has been pushed to a point near the operating platform. The operator places a new tray of bulbs on the track over the first tank and proceeds as follows: Any one tray is first lowered into position over the first tank A. Each bulb is now over a spray jet. The air valve for this tank is opened, closing the air-controlled valve shown in Fig. 4. The acid is allowed to spray the inside of the bulbs for a certain number of times and for a predetermined period. Meanwhile, the rack has been returned to position. The tray is raised and advanced by means of the air cylinder to the first wash tank. In the meantime, while the air pressure has been released from tank A, the air-controlled valve has opened automatically and allowed the acid to drain back. Then as the tray is lowered over the washing tank, B, the water valve opens automatically and washes the frosted surfaces. The treatment of the bulbs over tanks C and D corresponds to that over A and B respectively. It is evident, however, that all four operations are performed simultaneously, since there are four trays in the machine.

About 2 seconds is required for moving operations, about five seconds for loading and 21 seconds for spraying and washing with a total time cycle of about thirty seconds per tray.

As a consequence of the improvements and methods which have been mentioned above, inside frosted bulbs have now displaced clear glass from production for all common purposes.

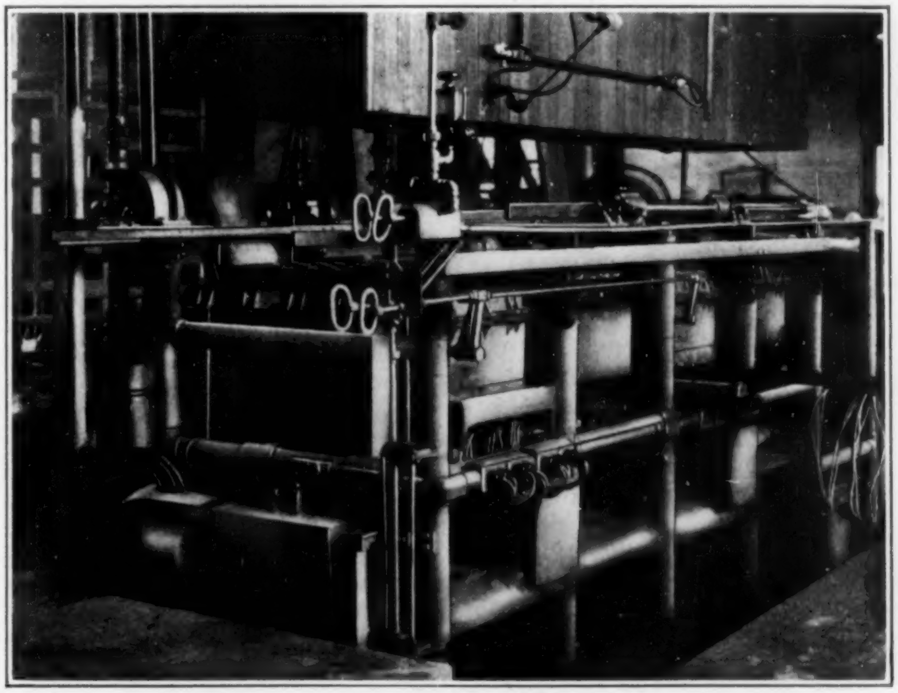


Fig. 6—Angular view of the frosting machine from the operating end

Handling Bulk Materials with Belt Conveyors

By Harry F. Geist

Engineer, Webster Manufacturing Company, Chicago, Ill.

BELT CONVEYORS are much in favor because their operation is smooth and free from noise, characteristics which promote long life and efficiency. From an engineering viewpoint, they stand out prominently because of the accuracy with which their performance can be predetermined.

The chemical engineer has often to estimate conveyor systems, for which purpose Mr. Geist's present article, as well as an extension and amplification of the subject by this author, which will be published in December, should be of great assistance

The material to be handled, its physical properties, the distance the material is to be hauled or elevated and the desired rate of handling, are usually known. With these as a working basis, tables which enable engineer or initiated layman to select the width and ply of belt required, the effective pull required for the haul, the speed, the horsepower required, the maximum permissible haul, and the size of the drive pulley and its shaft for either plain grease bearing type or anti-friction bearing type belt carriers are readily prepared. Table I is presented to show the usual capacities recommended in tons per hour for various belt widths, based upon a belt speed of 100 ft. per minute, for a range of materials weighing 25, 50, 75 and 100 lb. per cu.ft. Amounts carried in terms of lb. per ft. of belt are as listed for those capacities and are obtained by dividing tons per hour at 100 ft. per minute by 3. Values for 25, 50, 75 and 100 lb. per cu.ft. are used because they lend a flexibility and convenience to this system of tables, either for adjusting to the various materials which may be handled, or for adjusting to load percentages of full capacity. For example, if stone at 100 lb. per cu.ft. is to be handled, the values opposite 25, 50, 75 and 100 represent automatically the capacities at 25 per cent, 50 per cent, 75 per cent and 100 per cent of full load, as well as capacities at full load for materials at those weights per cubic foot. This form of presentation is adhered to throughout the tables, and is of value in cases where the length of haul desired may be such as to preclude a fully loaded condition. Thus in considering any case, the weight per cu.ft. and the percentage of full load should both be regarded. Other data given in Table I are similar to those found in such tables.

While the data of Table I have been compiled from experience, the tables to be given later are the result of calculations based upon known constants and formulas. So that the reader may thoroughly understand the derivation of the tables, it is thought advisable to include something of the theory of the calculations involved.

In order to pave the way for such a computation of values, it has been found necessary first of all to classify belt conveyors into several distinct types, based essentially upon the amount of initial tension required in the belt to insure traction of the belt with its load by means of its driving pulley under various conditions which may exist. Briefly, the items which affect the initial tension are: a, degree of snubbing the drive pulley to produce frictional wrap; b, frictional condition of drive pulley surface contacting with the belt, i.e., plain or lagged; c, uniformity of belt tension as controlled by the slack take-up means. Initial tension is customarily expressed as a percentage or decimal K of the effective pull A required to move the belt and its load continuously, and is represented by KA. For example, if 1,000 lb. is required to move the belt and its load, and K for the installation is 40 per cent, or 0.40, then the initial tension required will be 400 lb., and the maximum belt tension will be the sum of the two, or 1,400 lb. When it is appreciated that the value K may normally vary from 0.10 to 0.80, it is evident to what an extent initial tension may limit the maximum haul possible for a belt or build up the stresses in the conveyor system. The definite conditions which place different values upon K will be pointed out in the following.

Accepted tables which list the value K for various conditions cover a considerable range, to include all of which would result in a tabulation too elaborate and bulky for ready use. For all practical purposes, the following conditions may be considered typical:

Class No. 1—Bare head pulley, screw take-up, $K = 0.80$

Class No. 2—Lagged head pulley, screw take-up, $K = 0.67$

Class No. 3—Lagged head pulley, automatic take-up, $K = 0.40$

Class No. 4—Lagged tandem drive pulleys, automatic takeup, $K = 0.10$

Classes 1 and 2 are for conveyors having relatively short centers (about 100 and 200 ft. respectively) while Classes 3 and 4 may be used up to the maximum centers permissible for the belt under any loading.

For Classes 1, 2, and 3 snubbing for a wrap of about 210 deg. on the drive or head pulley is assumed. For Class 4 the wrap is assumed twice that value, there being two pulleys. See Figs. 3, 4, 5, and 6 for illustrations of these four classes.

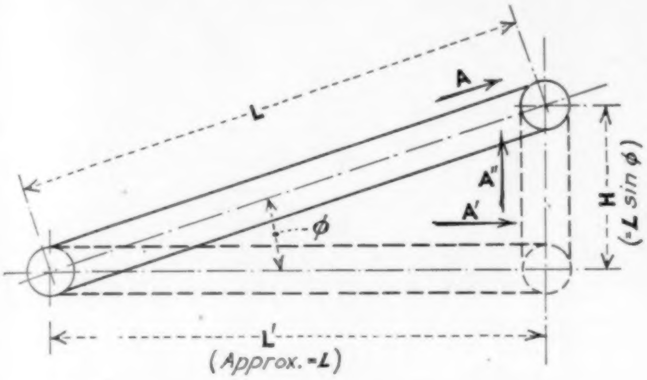


Fig. 1—Elemental Belt Conveyor System

With the conveyor types so classified it is now possible to derive a number of very useful formulas:

If A is taken as the force that must be exerted along a belt to move the belt with its load; W is the weight per ft. of belt of the conveyed material; and B, the weight per ft. of the belt itself, then A may be considered as made up of two parts for inclined conveyors: A', the horizontal, and A'', the vertical component of force. The work to be done consists in overcoming the friction of the carriers and in lifting the load against gravity. In Fig. 1, a typical case is shown. With L, the true length between centers, the component lengths are L' and H. But since it is rarely feasible to make the angle

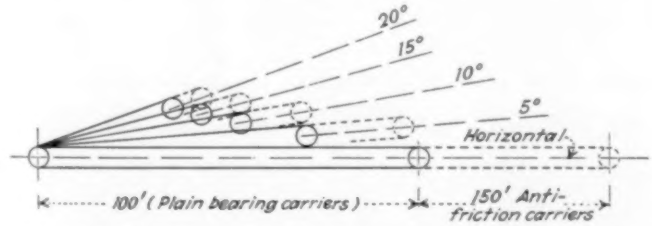


Fig. 2—Diagram Showing Equivalent Horizontal Centers for Sloping Belt Conveyors

Φ of the conveyor greater than 20 deg. as most materials cannot be conveyed at greater angles, it is permissible to use the true length L instead of its component L', because cos Φ is very nearly equal to unity for small values of Φ. Then, taking E as the coefficient of friction of the carriers, and $L \sin \Phi$ as H, it is evident that

$$A = LE(W + 2B) + WL \sin \Phi \text{ foot pounds} \quad (1)$$

If we wish to express the weight of material handled in tons per hour, T, and belt speed in ft. per min., S, then using the relation: $W = \dfrac{100\,T}{3\,S}$ we have:

$$A = LE\left(\frac{100\,T}{3\,S} + 2\,B\right) + \frac{100\,TL \sin \Phi}{3\,S} \text{ foot pounds} \quad (1a)$$

Obviously, for horizontal belts, the last term becomes zero, and will become negative for down-hill conveyors.

With A calculated, horsepower and total belt tension are found directly:

$$\text{hp.} = \frac{A\,S}{33{,}000} \quad (2)$$

and with C equal to lb. initial tension and D equal to total tension,

$$D = A + C = A + AK = A(1 + K) \quad (3)$$

Whence, knowing the working strength of the belt, P, in lb. per in. ply (see Goodyear's *Handbook on Conveyor and Elevator Belting*), the required number of plies, N, is determined:

$$N = \frac{D}{P\text{x Belt width}} \quad (4)$$

In order that belt conveyors of any slope up to 20 deg. may easily be calculated it is desirable to be able to consider them as horizontal and apply a factor dependent upon Φ. To accomplish this, equation (1a) must be solved for L

$$L = \frac{3\,SA}{E(100\,T + 6\,SB) + 100\,T \sin \Phi} \quad (5)$$

The effective pull, A, required for horizontal belts of various widths, plies and loads is computed from (1a) and substituted in (5) for various values of Φ. The resulting values of L are listed in Tables II and III as the pulley center distances for sloping belts equivalent to 100 ft. of horizontal belt with plain grease bearing type carriers. In other words, the term equivalent centers as applied in these tables means such centers as will set up

TABLE I—GENERAL BELT CONVEYOR DATA

Trough Belt, In.	Material: Lb. per Cu. Ft.	Material: Kind	Capacity: Lb. per Ft.	Capacity: Tons per Hour at 100 Ft. per Min.	Max. Lump 20 Per Cent In.	Max. Speed, Ft. per Min.	Carrier Spacing Ft.	"E" Carrier Friction: P. B.	"E" Carrier Friction: Roller B
18	25		4.34	13	5	450	5	.126	.0844
	50	Coal	8.67	26		350	5		
	75		13.00	39		300	4½		
	100	Stone	17.34	52		260	4½		
24	25		7.5	23	8	600	5	.118	.079
	50	Coal	15.00	45		400	4½		
	75		22.50	68		350	4½		
	100	Stone	30.00	90		300	4		
30	25		12.00	36	11	650	4½	.111	.0743
	50	Coal	24.00	72		450	4		
	75		36.00	108		400	4		
	100	Stone	48.00	144		340	3½		
36	25		17.20	52	14	700	4½	.105	.0703
	50	Coal	34.40	103		500	4		
	75		51.60	155		440	4		
	100	Stone	68.80	206		375	3½		
42	25		23.00	69	17	750	4	.100	.067
	50	Coal	46.00	138		550	3½		
	75		69.00	207		485	3½		
	100	Stone	92.00	276		425	3		
48	25		30.00	90	20	800	4	.095	.0636
	50	Coal	60.00	180		600	3½		
	75		90.00	270		525	3½		
	100	Stone	120.00	360		450	3		
54	25		40.00	120	23	800	4	.092	.0616
	50	Coal	80.00	240		700	3½		
	75		120.00	360		600	3½		
	100	Stone	160.00	480		475	3		
60	25		50.00	150	26	800	4	.090	.06
	50	Coal	100.00	300		700	3½		
	75		150.00	450		600	3½		
	100	Stone	200.00	600		500	3		

For selecting belt width divide capacity desired by speed suitable for material handled and choose belt width as per tons per hour at 100 ft. per minute listed above for similar material. Do not select a maximum speed for ma imum lump material.

equal stresses in the belt and the machinery as will a horizontal belt on plain grease type belt carriers. The use, as a base figure, of 100 ft. centers on such carriers results in all the other values in both tables automatically becoming percentages, which lend themselves to ease in

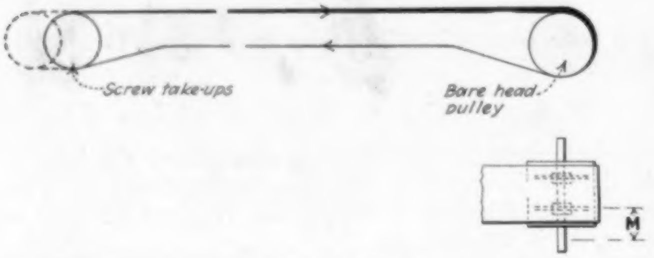


Fig. 3—Class I Conveyor, Bare Head Pulley, Screw Take-up

use. It should be noted here that interpolations may be made from Tables II and III by direct proportion without inducing any error sufficient to be of consequence.

As an example of the above, a certain weight of material may be conveyed 100 ft., horizontally, at a given speed and with a certain power requirement, using plain

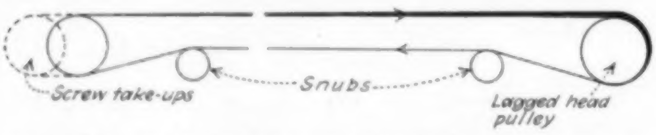


Fig. 4—Class II Conveyor, Lagged Head Pulley, Screw Take-up

grease bearing type carriers. If, however, the angle were increased to 10 deg., other factors being equal, then the conveyor length would necessarily be reduced to 67.7 to 72.3 ft. On the other hand, with everything else equal, a substitution of anti-friction type carriers would permit 150 ft. of horizontal run or 87.2 to 95.5 ft. of sloping conveyor length at 10 deg. inclination. This is indicated diagrammatically for a number of slopes in Fig. 2, which also shows that the greatest economy arising from the use of anti-friction type belt carriers is found in the use of horizontal conveyors and that the economy decreases as the slope increases. This is logical because for sloping belts the power component needed to elevate the materials is independent of friction.

TABLE II—EQUIVALENT CENTERS, FEET FOR PLAIN BEARINGS

Belt Width, In.	Material, Lb. per Cu.Ft.	Horizontal	5 Degrees		10 Degrees		15 Degrees		20 Degrees	
			Light Belt	Heavy Belt	Light Belt	Heavy Belt	Light Belt	Heavy Belt	Light Belt	Heavy Belt
18	25	100	81.0	84.1	67.7	72.3	58.5	63.7	51.6	57.0
	50		73.6	77.3	58.5	62.8	48.5	53.0	41.7	46.0
	100		68.0	71.0	51.6	54.7	41.7	44.8	35.1	37.9
24	25	100	77.0	80.3	62.6	67.0	52.8	56.5	45.8	50.8
	50		70.0	73.2	54.0	57.6	44.0	47.8	37.3	40.9
	100		64.8	67.1	47.6	50.5	38.1	40.7	31.9	34.2
30	25	1C0	75.2	78.7	60.4	64.7	50.5	55.0	43.7	48.0
	50		68.6	71.5	52.1	55.3	42.1	45.3	35.5	38.5
	100		63.1	65.6	46.1	48.5	36.4	38.9	30.2	32.3
36	25	100	72.8	76.0	57.4	61.3	47.7	51.3	40.8	44.8
	50		66.2	68.6	49.4	52.3	39.8	42.5	33.2	35.9
	100		61.0	63.0	44.0	46.0	34.7	36.5	28.6	30.25
42	25	100	70.7	75.6	54.7	60.2	44.7	50.2	38.0	43.2
	50		64.0	67.2	47.0	50.6	37.4	40.5	31.1	34.2
	100		59.5	61.5	42.3	44.5	33.0	35.0	27.2	28.9
48	25	100	69.0	73.0	52.7	57.4	42.8	47.5	36.2	40.6
	50		62.5	65.4	45.3	48.6	35.8	38.9	29.7	32.5
	100		58.0	59.8	40.7	42.8	31.6	33.4	26.0	27.5
54	25	100	67.2	71.0	50.6	55.2	40.9	45.3	34.3	38.4
	50		61.0	63.8	43.8	46.8	34.4	37.3	28.4	30.9
	100		56.7	58.5	39.6	41.3	30.6	32.2	24.95	26.4
60	25	100	65.5	70.0	48.7	53.8	39.1	44.0	32.6	37.2
	50		59.6	62.7	42.4	45.7	33.2	36.2	27.3	30.0
	100		55.5	57.5	38.5	40.3	29.7	31.4	24.2	25.6

For slope angles not listed between horizontal and twenty degrees, values equivalent to 100 ft. horizontal are obtainable by interpolation. Direct proportion between nearest values listed will be sufficiently accurate for all practical purposes.

TABLE III—EQUIVALENT CENTERS, ANTI-FRICTION BEARINGS

Belt Width, In.	Material Lb. per Cu.Ft.	Horizontal	5 Degrees		10 Degrees		15 Degrees		20 Degrees	
			Light Belt	Heavy Belt	Light Belt	Heavy Belt	Light Belt	Heavy Belt	Light Belt	Heavy Belt
18	25	150	110.0	116.9	87.2	95.5	72.4	81.0	62.1	70.4
	50		98.0	103.7	72.5	79.1	58.0	64.2	48.3	54.2
	100		88.0	92.7	62.3	66.7	48.5	52.6	39.0	43.4
24	25	150	103.0	109.3	78.8	86.3	64.0	71.5	54.0	61.2
	50		91.5	96.8	66.0	71.3	51.5	57.8	42.6	47.3
	100		82.7	86.3	57.2	60.6	43.7	47.1	35.6	38.5
30	25	150	101.0	106.2	75.8	82.3	61.0	67.5	51.2	57.2
	50		88.6	93.7	63.1	68.0	49.0	53.5	40.0	44.2
	100		81.0	83.9	54.6	57.8	41.5	50.3	33.7	36.2
36	25	150	96.5	101.5	71.1	77.2	56.8	62.7	47.2	52.8
	50		84.8	89.0	59.2	63.3	45.8	49.6	37.4	40.7
	100		76.7	79.8	51.6	54.3	39.2	41.6	31.7	33.6
42	25	150	92.3	100.2	66.8	75.0	52.6	60.0	43.5	50.2
	50		81.3	86.6	55.8	60.9	42.7	47.2	34.7	38.6
	100		74.2	77.4	49.2	52.2	37.0	39.6	29.8	31.9
48	25	150	89.6	96.5	63.9	71.1	50.0	56.5	41.1	47.1
	50		78.7	83.7	53.3	58.0	40.6	44.7	32.9	36.4
	100		71.8	75.0	47.2	49.8	35.3	37.6	28.4	30.4
54	25	150	86.5	93.1	61.0	67.6	47.3	53.4	38.7	44.1
	50		76.5	81.2	51.3	55.5	38.9	42.6	31.3	34.4
	100		70.0	72.3	45.6	47.9	34.1	36.0	27.2	28.9
60	25	150	83.9	91.2	58.2	65.5	44.8	51.4	36.6	42.3
	50		74.1	79.1	49.3	53.8	37.2	41.2	30.0	33.2
	100		68.2	71.3	44.2	46.7	32.9	35.0	26.25	28.0

Above values are equivalents to values in Table II for corresponging belts and loadings. See note under Table II. These tables are presented for determining the horizontal equivalent (with plain type bearings) for any belt conveyor, or loading at any slope or type bearing within the above limits.

Tables II and III apply equally to conveyor classes, 1, 2, 3, or 4.

We now have at hand means for calculating the total tension and effective pull of a belt, the number of plies and the hp. required, as well as the center distances for

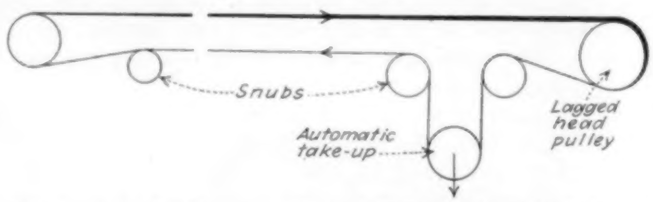


Fig. 5—Class III Conveyor, Lagged Pulley, Automatic Take-up

various conditions equivalent to a standard form of horizontal belt conveyor. It is desirable to be able to calculate a conveyor to fit a given set of conditions so that the proper belt will be used in connection with a shaft of sufficient size to permit the length of carry required. To do so three limiting factors must be considered: (1)

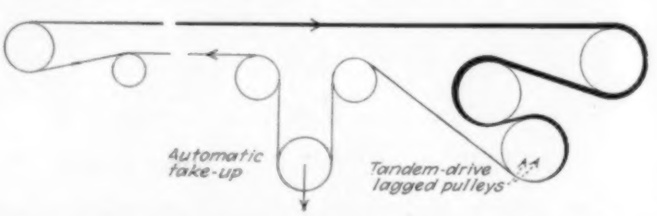


Fig. 6—Class IV Conveyor, Lagged Tandem Drive Pulleys, Automatic Take-up

Normal working strength of the belt; (2) bending of the head shaft; (3) torsion in the head shaft. For any given set-up and load conditions these three conditions limit the center distance of the conveyor. It is obvious, of course, that if a belt is adapted to a span, while the head shaft is not sufficiently rigid, that a larger head

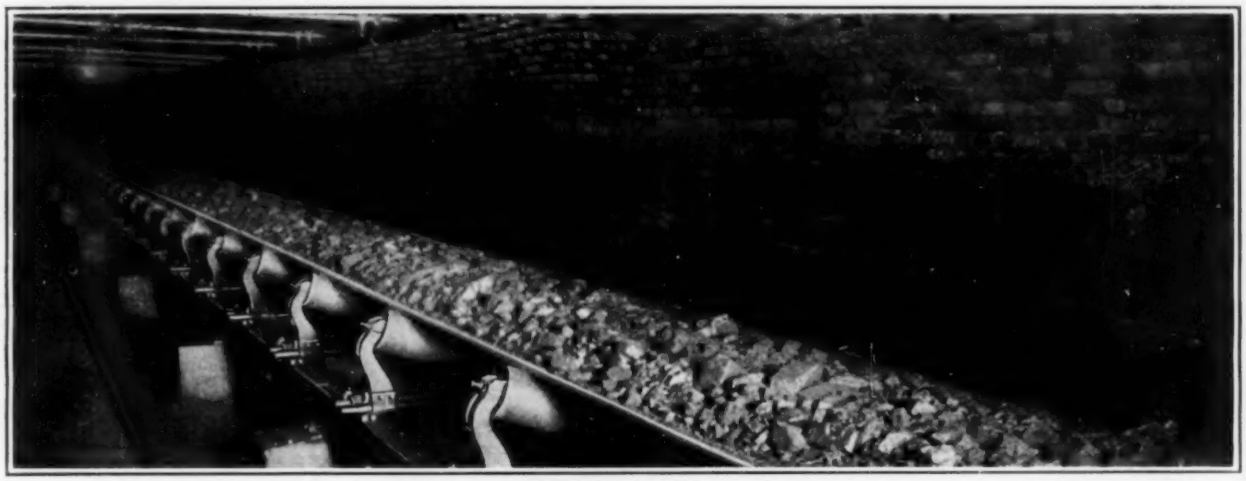


Fig. 7—Typical Belt Conveyor Installation

shaft may be used, and the reverse of this is also true.

To determine the allowable center distance for any belt, assuming a suitable shaft, we have only to substitute the appropriate value of K, the constant previously discussed in connection with the four general types of conveyors, in equations (3), $D = A(1 + K)$, where D is made to equal the specified normal full working strength of the belt. Solving for A, we get the total allowable effective pull, which when substituted in equation (5) gives the maximum allowable center distance.

Similarly, to determine the maximum center distance for any shaft, we calculate the total allowable effective pull for the shaft and class of conveyor, and determine the allowable center distance again from equation (5). From any engineering handbook it is possible to determine the allowable pull on a shaft for a given span between head shaft bearing center and the near side of the pulley hub. This distance is called M. The allowable force F, thus determined is largely the belt reaction, and neglecting the weight of the pulley, may be evaluated as:

$$F = \frac{A(1 + 2K)}{2} \qquad (6)$$

The divisor, 2, results from the division of the load between two bearings supporting the two halves of the shaft. Therefore, when the value of A thus obtained is substituted in equation (5), taking proper consideration of the shaft torque as well, the allowable belt center distance is easily found for the shaft in question.

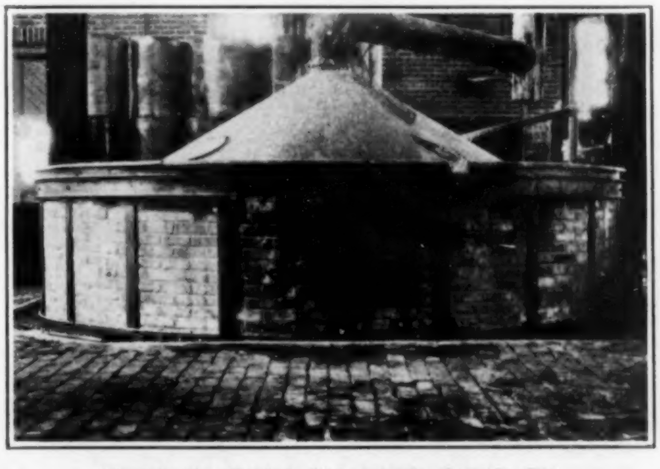
By way of summary it should be stated that, in general, belt conveyors are divided into four classes depending upon the method of applying power. The drive pulley may be either lagged or unlagged and provided with a screw take-up. Or, automatic take-up may be used, in which case either single or tandem drive pulleys furnish power to the belt. The valve K, the initial belt tension required to insure proper traction, is thus evidently dependent upon the class of drive used.

Proper loads for various belt widths are determined empirically as well as suitable speeds. Since the work performed in moving the belt and load consists in overcoming the friction of the carriers and in lifting the belt and load against gravity, the power requirement may be determined, once the handling rate and carrier characteristics are known. This follows directly from a calculation of the effective tension, which taken with the initial tension, provides a means of determining the number of plies necessary. It has also been shown that sloping belts may easily be compared by considering them as equivalent to a standard horizontal belt. And finally we have seen that the allowable stress for any belt may be computed and from it, the permissible conveyor length as well as the head shaft size demanded by the various conditions. These methods enable the designer to calculate belts for every requirement.

Electric Fusion Pots for Caustic Soda

The use of electric heat for fusing caustic soda on a commercial scale has been accomplished for the first time by the Riordon Pulp Corporation, of Temiskaming, Quebec. It is estimated that the corporation saves more than \$10,000 annually with the electric process. The caustic which is dehydrated is a 40 per cent solution.

The solution is pumped to the electrically heated pots where it is fused. The pots, which are 10 ft. in diameter and 6 ft. deep, will hold approximately 2,600 imperial gallons each. They are set in brick work consisting of 4½ in. of red brick outside, 9 in. of insulating brick and a 4½ in. fire brick wall inside. Canadian General Electric heating elements having a connected load of 500 kw. at 550 volts, 3 phase, supply the heat. Automatic temperature control is provided by thermocouples located in the chamber outside the pot, which work in conjunction with control panels. The heating elements are protected from a possible overflow of molten caustic by steel aprons fitted tightly to the pots and carried outside the brick work.



Electrically Heated Atmospheric Caustic Pot

High Throughput Characterizes New Coking Process

By Graham L. Montgomery
Assistant Editor, Chem. & Met.

A CARBONIZING system that combines the advantages of high throughput and ability to utilize such raw materials as high oxygen Illinois coal, holds great promise for all coal-using industries. Such a system, based on the carbonizing process developed by Prof. S. W. Parr and T. E. Layng of the University of Illinois, has been worked out by the Urbana Coke Corporation, Urbana, Ill., and one unit is now in successful commercial operation.

Referring to the diagram, the coal is first crushed so that the largest pieces are about pea size. It is fed from the crusher into a bucket elevator which raises and discharges it into the preheater. After passing through the preheater, in which it undergoes the first step of the carbonizing process, it passes into a preheated coal storage bin. This bin is arranged so that it can be raised to the top of the coking chamber and moved over the charging hole. Charging is accomplished through a gate in the bottom of the bin.

The oven is of the horizontal, recuperative coke-oven type, as designed by the Russell Engineering Company, and similar to those installed in the gas plant at Quincy, Ill. These ovens are ordinarily of two tons capacity, but the oven installed at Urbana is one-half the usual length and holds but one ton. Firing is by producer gas, made in a producer attached directly to the oven setting, thus making the direct heat of the producer also available for heating the flues. The oven is equipped with a motor-operated pusher, which, after coking is completed, pushes the coke out. The discharged coke passes through a chute to the quenching station, where water is sprayed on it.

The gas passes through a conventional offtake to a combined cooler, condenser and scrubber, where the gas is cooled and the tar and liquor removed to storage. From the scrubber, the gas passes through the meter to

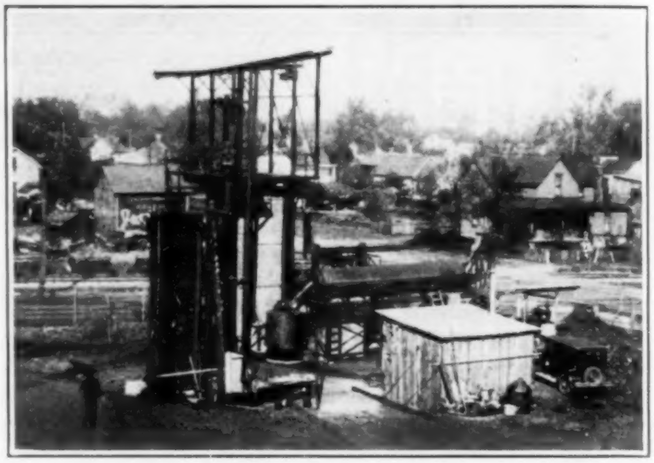


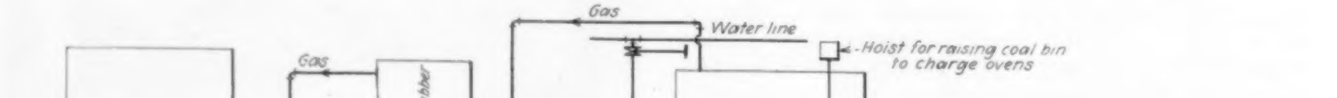
Fig. 1—First Unit Installed by the Urbana Coke Corporation, of Four Tons Daily Capacity

the holder, from which it is mixed with the carburetted water gas produced by the local gas company and distributed to local consumers.

The exact conditions of operation naturally vary with the character of the coal being used, but the conditions obtaining during the writer's recent visit are such as to give a good average picture. The coal in use was an eastern Kentucky high-volatile coal of the following analysis:

Moisture	2.90 per cent
Volatile matter	37.50 per cent
Fixed carbon	56.20 per cent
Ash	3.40 per cent
Sulphur	.90 per cent
B.t.u.	14,100

This coal contains somewhat less oxygen than the Illinois coal ordinarily used. This results in less improve-



Diagrammatic Layout of the Modified Parr Process Plant Used by the Urbana Coke Corporation

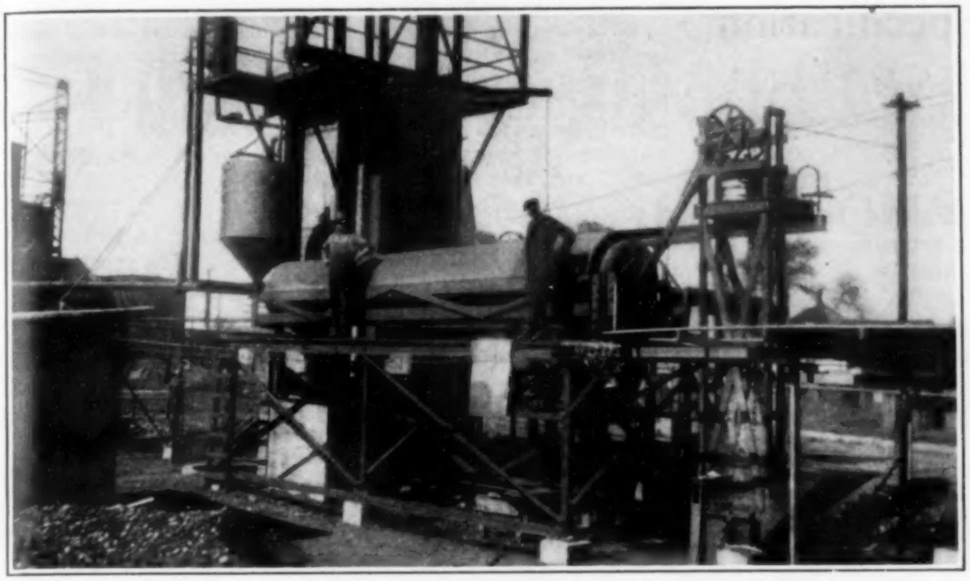


Fig. 2—Coal Preheater With Bin for Preheated Coal Partly Raised at Left and Raw Coal Elevator at Right

ment being effected by the preheating process, but otherwise makes no difference. The coal is run-of-mine and is reduced in size in a crusher until no piece is greater than ½ in. It is then fed into the preheater for conditioning. The preheater is a steel drum, slightly inclined toward the discharge or hot end. It is heated by waste heat from flue gases that have passed through the heating flues of the oven. These gases pass through a metal jacket around the preheating drum, entering at the discharge end of the drum and passing out at the opposite end. The entrance temperature varies from 450 to 500 deg. C. and the outlet temperature is 150 deg. C. These temperatures result in imparting a final heat of 300 deg. C. to the coal, which is stored so as to retain as much of this heat as possible until it is charged into the oven.

The entire preheater is continuously revolved in a manner similar to the revolution of cement kilns or rotary driers. The discharge end is equipped with a series of radial partitions, extending from the shell toward the center, which serve to guide the coal to the central discharge leading to the chute that carries the coal to the storage hopper.

The preheating treatment has three results, these results serving to make possible the advantages realized from the whole process. It removes all moisture from the coal, it removes the oxygen in the form of CO_2, and it permits of the oven being charged with coal that is already partially heated. The removal of the moisture and the partial heating have a marked effect on the throughput of the oven, while the removal of the oxygen, which also increases the throughput, is responsible for the ability of this process to coke coals that cannot be coked by other processes.

The oven is of one-ton capacity. The flue temperatures vary from 1,180 to 1,350 deg. C. the coal being coked at a maximum temperature varying from 750 to 800 deg. C. Under these conditions the coking time varies from 5 to 6 hours, depending on the coal. This coke is distinctly not a semi-coke, but is comparable in physical qualities to a high-temperature coke. In addition, although the volatile content of this coke is low, being often below 5 per cent, it ignites easily, having a greater reactivity than high-temperature coke.

The byproducts obtained from this process comprise about 20 gal. of a true low-temperature tar per ton of coal carbonized and 9,000 cu.ft. of 700-B.t.u. per cu.ft. gas. The coke represents 65 to 70 per cent by weight of the original coal charged. This coke has been found by test to be a highly satisfactory raw material for producer gas and water gas, as well as a high-grade fuel.

While no figures are as yet available to show the overall economy of the process, which would in any case depend largely on local conditions, nevertheless the low grade of coal that can be used, the high throughput obtained and the good quality of the products promise a wide field for this process. One of the most promising uses at present in sight seems to lie in enabling water gas plants so to improve the quality of a low-grade local fuel as to make a good generator fuel from it, at the same time producing sufficient high B.t.u. gas to enrich the low B.t.u. water gas up to the local standard without or with less carburetion. The high quality of the coke also holds forth promise of help in smoke abatement in localities where the fuel used by domestic consumers is a smoky bituminous coal, as is the case in the locality when this process was developed.

The data upon which this article is based were released through the kindness of Prof. S. W. Parr and F. B. Hobart of the Urbana Coke Corporation and C. E. McDonnell, service operator, Russell Engineering Company.

Fig. 3—Russell Coke Oven Used as Part of the First Unit of the Urbana Coke Corporation Plant, With Combined Cooler, Condenser and Scrubber at Right and Pile of Coke in Foreground

How to Write a Specification

By Charles Kirkbride

Supervisor, Standards and Specifications Division, United States Naval Aircraft Factory, Philadelphia, Pa.

A SPECIFICATION is a complete and definite statement of what a buyer requires of a seller. When formulating a specification, it should be borne in mind that it must be adapted to the best practice of production and distribution; furthermore, it should be noted that no real economy can be obtained by writing a specification for an article that will require that it be specially manufactured when an article largely produced for commercial consumption will give equal service, or by incorporating special requirements that will increase the cost of production without compensation in service.

It sometimes requires many months of hard work to prepare a satisfactory specification and its formulation may require the direct or indirect services of chemists, physicists, engineers and practical men. It then remains to give it an actual working test.

The first requirement in the preparation of a specification is to get together all available information concerning the article or material which the specification is intended to cover. This can best be accomplished by communicating with various manufacturers and by consulting with retailers and other concerns who have actually used the article or material in question. With this information and the added experience of the concern for whom the specification is being written, it then but remains to record this information as concisely as possible, but at the same time in a form comprehensive enough to eliminate any chance for possible error through misinterpretation.

Following is an outline of a form for a specification which contains seven paragraphs with general instructions as to the specific subject matter of the specifications that should be incorporated in each paragraph. The basis of this standard form lies in the fact that similar requirements will thus always appear in the paragraphs (of all specifications) bearing the same number.

Outline Form of a Typical Specification

1. Types, Grades, Classes, Etc, (as applicable).

In this paragraph should be listed the several types, grades, or classes of articles or materials covered by the Specifications preceded by the words: " . . . . shall be of the following types (grades, classes, etc.)." If only one type, grade, class, etc., is required, it should be so stated. The types, grades, classes, etc., (if more than one) should be listed under a brief name convenient for reference and in accordance with commercial practice, as far as practicable, and should be designated by Roman numerals or capital letters. Small letters may be used if the use of capital letters would necessitate changing standard plans. The same designations should be used under "Detail Descriptions," paragraph 4 and in paragraphs 5, 6 and 7, as applicable, so that paragraph 1 will serve as an index to the subject matter of the specification. If other types, grades, classes, etc., of similar articles or materials are covered by other specifications, they should be listed, indicating the appropriate specifications.

2. Material and Workmanship, Etc.

Under this heading should be included any necessary requirements relative to the method of manufacture, also the character or quality of the materials used and the workmanship. Any requirements with reference to the use of scrap should be here stated.

3. General Characteristics:

All essential characteristics and descriptions which are applicable to the articles or materials and which are common to all of the types, grades, classes, etc., covered by the specifications should be stated in this paragraph. Tolerances permitted, if common to all types, grades, classes, etc., should be included. If spare parts are required for all types, grades, classes, etc., they should be listed here.

4. Detail Descriptions.

In this paragraph, the items listed in paragraph 1, "Types, Grades, Classes, etc., should be considered, when practicable, consecutively, using the name and designation in full, detailing for each such physical and chemical requirements, characteristics and descriptions as may be necessary to define clearly the articles or materials required. The following, when applicable, should be included; the statements under each heading being contained in a separate paragraph, properly lettered: Physical Requirements; Chemical Requirements; Treatment; Finish; Plans; Sizes; Tolerances; Spare Parts not listed in Paragraph 3.

5. Method of Inspection, Tests, Etc.

In this paragraph should be stated the tests to which the articles or materials are to be subjected in order to determine whether or not they conform to the requirements of those specifications of tests and methods of inspection as may be necessary to insure that they will be properly and uniformly conducted, and other information, such as location of test specimens, method of taking chemical analyses, etc.

6. Packing and Marking of Shipments.

In this paragraph should be described the manner in which the articles or materials are to be marked and packed and also the marks which should appear on the containers before shipment, and such other information as may apply.

7. Notes to Bidders, Manufacturers, and Others.

This paragraph should contain any information which may aid in selecting the Specifications applicable to the articles or materials used. When it is desirable to specify the purpose for which the material is to be used, such statement should appear in this paragraph; also the following when applicable:

Bids for furnishing (. . . . .) differing from the requirements of these specifications will be considered, provided the bidder clearly describes in his bid the specific points in which (. . . . .) he proposes to furnish differ from the requirements of these specifications, and provided further that the differences are indicated as such. When exceptions are not clearly described and indicated as such it will be assumed that bidders are offering (. . . . .) in strict accordance with these specifications. Any instructions relative to the submission of samples for test previous to the submission of bids or award of contract should also be specified in this paragraph.

While it is believed that the foregoing form can be used for practically all specifications, it is possible that there may be some instances where its use is not entirely practical, and in such cases necessary deviations from the form may be made.

Study CO Hazard in Garages

To determine the seriousness of carbon monoxide hazards in large garages, continuous CO records were kept by S. H. Katz and H. W. Frevert in two large garages, one in Washington and one in Pittsburgh. They found that the maximum indication was above 8.3 parts per ten thousand on a few occasions, but only momentarily. In most cases during working hours carbon monoxide in these establishments was from 1 to 2 parts, the highest average for any hour being 4.33 parts per ten thousand. It is concluded that the quantity of carbon monoxide in such establishments is not injurious unless in very cold weather the garages are kept tightly closed and care is not exercised to reduce the time during which engines are allowed to idle while indoors.

Efficient Design and Operation of Absorption Towers

By H. L. Kauffman

Petroleum Consultant, Denver, Colo.

THE THREE principal methods by which gasoline is extracted from natural gas are as follows:

1. Compressing the gas in large, powerful compressors and then passing the compressed gas through cooling coils in which the gas condenses into a liquid state.

2. Passing the gas through absorption towers that contain an absorbent oil having an initial boiling point higher than the end point of the absorbed natural gasoline. The absorbent oil is later distilled, in order to separate the gasoline vapors.

3. Passing the gas through charcoal in which the gasoline content of the gas is absorbed.

In a large number of plants the compression and absorption systems are used in combination.

The present article will discuss, briefly, the construction details of a bubble tower type of absorber that is being used more and more extensively throughout the Mid-Continent and other fields.

Fig. 1 shows the construction details of an absorber containing 10 bubble trays. This tower is 6 ft. in diameter and $27\frac{1}{2}$ ft. in height. The trays are spaced at 20-in. intervals. A 4-in. down-spout connects each tray with the one below it, the lower portion of this "downpipe" resting upon a flange $1\frac{1}{2}$ in. above the tray proper. The first tray is placed 6 ft. from the bottom of the tower; the tenth, 21 ft. from the bottom.

A mist extractor, the construction of which may be noted from a study of Fig. 1, is located $3\frac{1}{2}$ ft. above the highest tray. From the top of the two trays composing part of the mist extractor a 3-in. down-spout pipe leads to a 6-in. tube seal that rests on the tray beneath.

Bottom and top heads are made of $\frac{3}{8}$-in. steel plate; $\frac{5}{8}$-in. rivets are used throughout. A 16-in. manhole is provided near the bottom. For other construction details, such as location of flanges, gage glass connections, level control, etc., the reader is referred to Fig. 1.

Fig. 2 shows the construction of a tower of similar design, 6 ft. in diameter by 30 ft. in height, but provided with several temperature control elements for regulating the temperature of the liquid on particular trays. These elements can be used either for equalizing the heat of absorption or for heating for fractionation purposes. In this tower the first three trays are spaced at 30-in. intervals; thereafter, at 20-in. intervals.

At 30 lb. working pressure absorbers of this design have a rated capacity of 8,000,000 cu.ft. daily with 80 deg. F. absorption oil entering the column, although many companies have been able to put through as much as 12,000,000 cu.ft. in 24 hours. Operation can be carried out using either very small quantities of gas or up to the capacity of that particular absorber. It is claimed by the manufacturers (Tulsa Boiler & Machinery Co.) that under proper operating conditions, at 30 lb. pressure, the residue gas can be cleaned up to as low as 10 gal. per million cu.ft.

At 30 lb. working pressure a 5-ft. by $26\frac{1}{2}$-ft. absorber

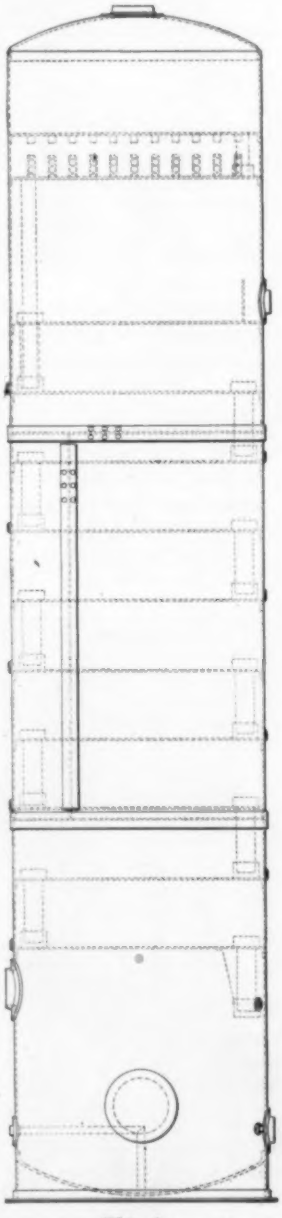


Fig. 1
10-Tray Absorber

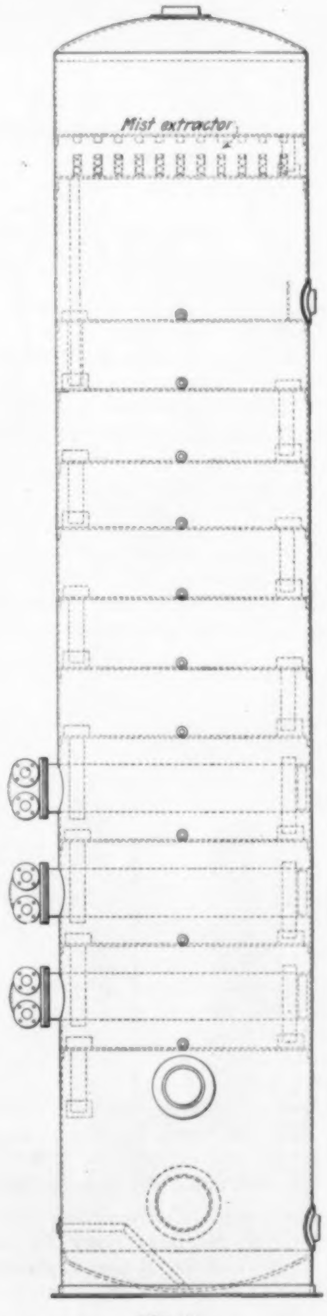


Fig. 2
Absorber with Heating Elements

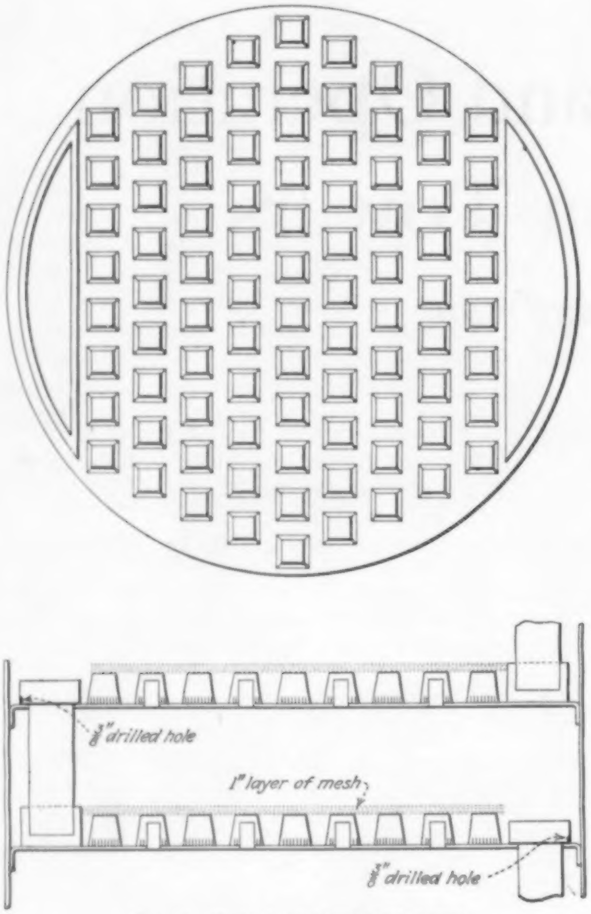


Fig. 3—Detail of Mist Extractor

of this design has a rated daily capacity of 5,000,000 cu.ft.; a 4-ft. by 26½-ft. absorber, a capacity of 3,500,000 cu.ft.; and a 3-ft. by 26½-ft. tower, a capacity of 2,000,000 cu.ft. in 24 hours.

Fig. 3 shows the construction details of the bubble tray used in this particular absorbing tower, including the spacing of the bubble caps, size and arrangement of the liquid level and down-spout pipes and the arrangement of the 1-in. layer of mesh over the bubble caps.

Equal in importance with proper design of an absorber for efficient operation of an absorption gasoline plant is the grade of absorbent oil used.

The oil used in the absorber should be of good *color* in order to insure no discoloration of the finished natural gasoline by the presence of small quantities of the absorbent oil. Its *initial boiling point* should be well above the maximum boiling point of the natural gasoline. Further, it should be *sweet* to the doctor test so that there is no danger of contaminating the finished natural gasoline by the presence of small quantities of sour absorbent oil.

Other properties of a satisfactory absorbent oil should be as follows:

Viscosity should be low in order to secure maximum distribution.

Vapor pressure should be low in order that losses due to saturation of all natural gas treated with absorbent oil may be reduced to a minimum.

Unsaturation should be low in view of the fact that products containing a high percentage of unsaturated compounds do not seem to be the most suitable as absorbent oils.

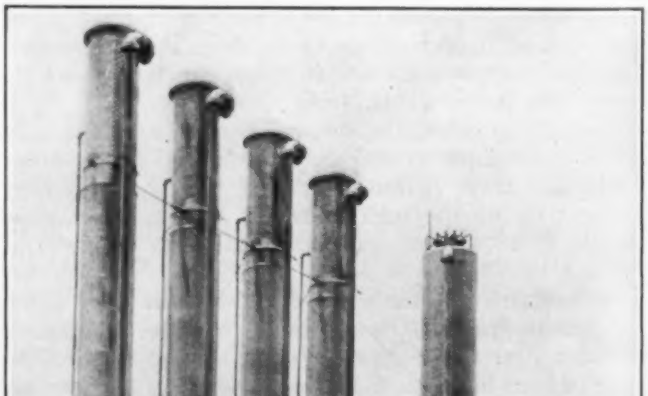
Saturation should be high, since the maximum saturation obtainable from gas of any given natural gasoline content, with equal recovery, lowers the costs of operation.

Pour point should be low so that satisfactory circulation and distribution of the absorbing medium may be had under all the operating temperatures that are encountered.

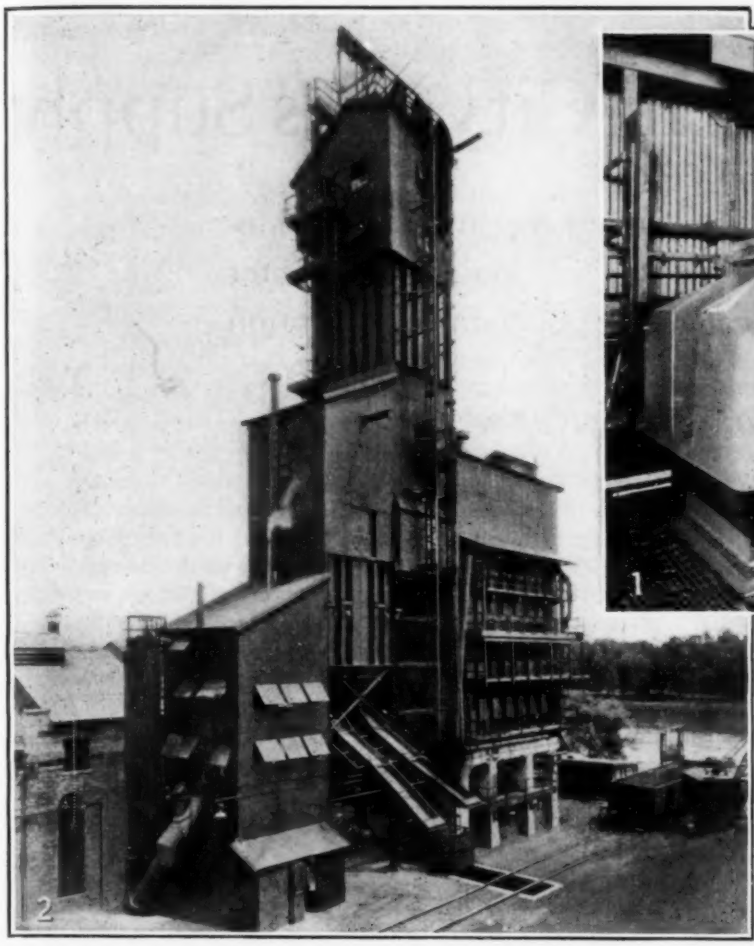
Emulsion test on the oil should be good in order that no emulsion troubles in the system can originate with the absorbent oil.

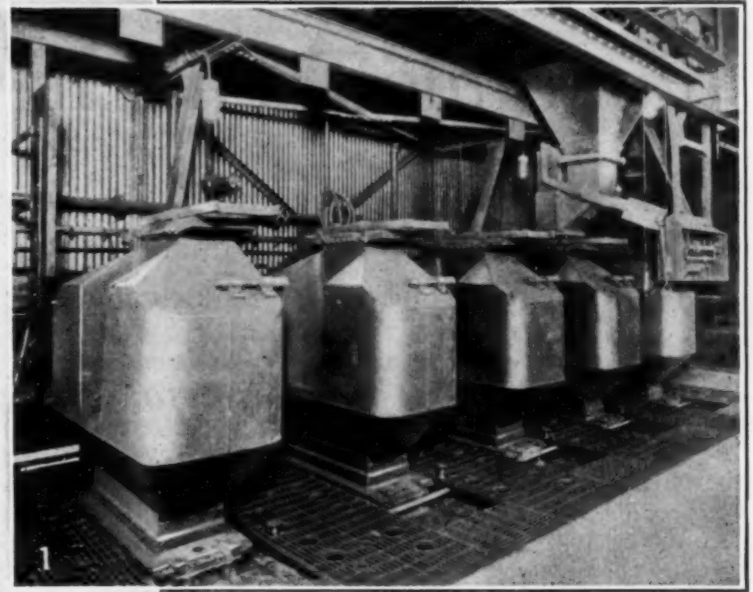
The writer wishes to acknowledge his indebtedness to M. H. Kotzebue, superintendent of the Tulsa Boiler & Machinery Co., for drawings and data used herein.

Absorber in Flush Pool Operating under 5 lb. Pressure



High Pressure Absorbers in a Louisiana Gasoline Plant





Continuous Vertical Gas Ovens

This installation of a 5-oven battery by the Koppers Construction Company for the Illinois Northern Utilities Company at Sterling, Illinois, began operation in June, 1927, with a gross gas-making capacity of 750 M cu.ft. per 24 hours, treating 12 tons of coal per oven per day. Charges of predetermined percentages of coarse and fine coal are introduced at two-hour intervals into the feed hoppers and coke is continuously extracted from the base of the oven after quenching in the bottom section by steam.

The ovens are heated with producer gas made in an outside producer from the fine coke. The heating system provides preheated air and fuel gas through regenerators and the burning is alternately in the two adjoining heating units with reversal at 30-minute intervals, as in Koppers coke-oven construction. Underfiring with a portion of the oven gas can be arranged readily at the wish of the operator, in which event only the air is preheated.

Yields obtained from the Harlan County, Kentucky, coal used are 12,630 cu.ft. of gas, 14.3 gallons of tar, and 1360 lbs. of total coke, all per net ton of coal of 2.5 per cent moisture content. Approximately 171 lbs. of the fine coke is used in the producer per ton of coal processed. The gross heat in the gas made is 3671 B.t.u. per pound of dry coal, the gas having 567 B.t.u. per cu.ft. total heating value.

In the accompanying photographs the general view of the plant is shown in Fig. 1, the coal magazines and weighing larry are shown in Fig. 2, Fig. 3 shows the air and fuel-gas inlets, and Fig. 4 shows the coke extractor.

Economic Trends in City-Gas Supply

Engineering study and important experimental developments, including manufacture of low-gravity water gas, reported at American Gas Association convention

Editorial Staff Report

THE ENGINEERING and economic survey of the gas industry, which occupied the headliner position for the 1927 American Gas Association convention program, has necessitated a thorough chemical engineering study of gas-making processes. Thus it appears that gas engineering is more and more adopting the customary methods of chemical-engineering investigation and development, compelled by the necessity of modifying its manufacturing methods in order to supply city gas to meet increased variation in customer demand. The gas industry is, in fact, finding it necessary to study entirely new manufacturing procedures in the hope that it will thereby eliminate the objectionable variations in quality of service at the customers' premises which the older methods of manufacture have often made inevitable under changing load conditions.

The Gas Industry's Problem

A progress report was rendered by H. E. Bates, chairman of the committee on engineering and economic survey, summarizing in considerable detail the problem which confronts the industry. This problem is essentially created by the necessity for supplying largely increased volumes of gas for house heating, a source of seasonal loads and consequently of serious variation in gas requirement. The industry has during the past ten or twelve years, according to this report, increased its sendout by more than 100 per cent, but increased the number of meters only about 46 per cent. The resulting increase in sales per meter has afforded a distinct advantage to the industry; but an offsetting effect is anticipated in the event that house-heating becomes general, since this load, although increasing individual customer requirements, prevails for six months or less each year.

The committee has given most attention thus far to determining the influence of these changing load factors upon the relative importance of operating expense and investments. It is pointed out that for a plant having a uniform load, or for the portion of the plant which is used for base-load purposes throughout the year, it is most important to reduce the operating expenses. On the other hand, for that portion of the plant that is used only seasonally it is often economically desirable to plan for such an installation as may have high operating charges in order that a net saving may be accomplished through the greater reduction of capital charges.

The committee points out that, speaking generally, these facts clearly indicate the desirability of using coal-gas plants for base-load supply, but water-gas plants for seasonal peak-load supply. The meeting of the problem which is presented to the industry would be relatively simple if such a mixed-gas system were always feasible and if a mixture of any proportion of the two gases could be supplied at any time at the option of the management. However, such a combination plant introduces two complications: First, the marketing of surplus coke; and second, the caring for customers' service when the composition, specific gravity, and appliance behavior of the gas varies, as would be the case if widely varying mixtures of coal gas and carburetted water gas were sold.

The problem of maintaining a constant quality of gas has been considered by the committee from several points of view, viz.; the raising of the specific gravity of the coal-gas base load, the lowering of the specific gravity of the carburetted water gas, the determination of the maximum variation in specific gravity which the customers' appliances will tolerate, and the effect upon the distribution system of varying specific gravity. The committee has also had the co-operation of distribution engineers in the analysis of the problems of long-distance transmission of gas between cities, the supply of suburban areas from central manufacturing works, and the relative merits of low-pressure and high-pressure distribution systems for handling increasing gas loads. These several subcommittee contributions are reviewed briefly below, and there is given an extended abstract of the very important paper by Louis Stein and L. J. Willien on a new method of manufacturing carburetted water gas of low specific gravity.

Specific Gravity Affects Usefulness

In order that the engineering estimates for the future can be most effectively made it was found necessary to determine by experimental study what was the effect of specific gravity on the utilization of various gases and their mixtures in household and industrial appliances. This investigation has been undertaken at the central laboratory of the A.G.A. in Cleveland and a portion of the work was reported to the convention by George B. Shawn, laboratory supervisor. The work which has been completed dealt with appliance tests of various mixtures of coke-oven gas, carburetted water gas, producer gas, blue gas, and natural gas. A variety of household and industrial appliances were adjusted for one condition of gas supply and then other kinds of gas were then fed to the burners. Thus the safe practical limits for variation in the supply reaching the customers' premises were determined.

Mr. Shawn summarized the test results thus far available as indicating a tolerable variation not more than 20 per cent upward nor more than 10 per cent downward in specific gravity from that of the gas for which the appli-

ances are adjusted. He pointed out, however, that such limits indicated the permissible variation in specific gravity when one assumed constancy of pressure and of chemical composition and that with variation in these factors the permissible variation in the specific gravity might be further restricted.

A paper presented by J. A. Perry, of the United Gas Improvement Company, discussed the mixed-gas problem from the standpoint of plant operation. Mr. Perry's recommendation is that the specific gravity of coal gas, normally about 0.38, should be increased by admixture of producer gas or other heavy gas so that even during the season of low load the gravity of the gas supplied would not be too low. One of the mixtures suggested was coal gas modified with producer gas to a specific gravity of 0.43. Other mixtures suggested were of lower heating value, generally about 400 B.t.u. per cubit foot, including more producer gas and having a specific gravity as high as 0.57. With this gas for base-load supply Mr. Perry concludes that the peak-load period could be cared for with admixture of very large quantities of water gas, either carburetted or uncarburetted as might be required by the prevailing heating-value standards. In general his recommendations were for the use of present-day manufacturing methods and apparatus rather than the installation of new manufacturing equipment.

Off-Peak Use of Water-Gas Apparatus

Because of the limited season during which peak-load water-gas apparatus is needed for city supply the proposal has frequently been made that this water-gas capacity be used as a basis for chemical manufacture. Hydrocarbon or alcohol synthesis by the Fischer process or hydrogen manufacture for use in chemical industry or in coal liquefaction, as by the Bergius process, are outstanding proposals of this character which have been investigated during the past year by a chemical subcommittee working under the general guidance of the survey committee. A. C. Fieldner, of the Bureau of Mines, reported the conclusions of this group.

The investigations on the use of uncarburetted water gas for methanol or hydrocarbon synthesis were of an economic nature only. They indicated that the present market, both for methanol and for such gasoline substitutes as might be made, did not appear favorable to these procedures. Moreover, in all cases the new investment required for use of the water gas would be so great that the complete plant would include from two to four times as much methanol or hydrocarbon-plant equipment as gas-plant equipment. Hence, on the score of plant investment alone it would be evident that the gas-plant equipment must be available for more than 67 to 80 per cent of the year to be economically used in chemical manufacture. This means that only such peak-load water-gas equipment as might be required for gas making less than 20 to 33 per cent of the time could be considered as adaptable to chemical-plant uses, as a measure of economy of investment.

As a test of the usefulness of the water-gas plant for hydrogen making a set of conditions was assumed under which the hydrogen was to be used for ammonia synthesis. Several phases of this question were investigated, in part by E. R. Weaver, of the Bureau of Standards; in part by F. A. Ernst, of the Fixed Nitrogen Research Laboratory and S. P. Burke, of the Combustion Utilities Corporation; and in part by these gentlemen and Dr. Fieldner in association with R. L. Brown, of the Pittsburgh Station of the U. S. Bureau of Mines. The conclusions from these several studies are summarized by the committee as follows:

1. The investment cost per M per day of blue gas for chemical purposes ranges between a minimum of $75 and a maximum of $150.

2. The total investment, per annual ton, required for an ammonia plant of 10-tons-daily capacity is

	Minimum	*Maximum*
Gas plant	$ 26	$ 52
Ammonia plant	125	125
	$151	$177
Ratio of gas plant to ammonia plant	1:5	1:2.5

3. The total investment per annual ton, required for a methanol plant of 20-tons-daily capacity is

	Minimum	*Maximum*
Gas plant	$ 21	$ 42
Methanol plant	86	86
	$107	$128
Ratio of gas plant to methanol plant	1:4	1:2

4. On the basis of the maximum gas-plant-investment figure, the gas industry might consider the utilization of off-peak water gas for the manufacture of either ammonia or methanol, provided a market is available.

5. On the basis of the minimum gas-plant-investment figure the advantage of the gas industry over the chemical manufacturing industry disappears.

6. Other factors militating against the general production of synthetic ammonia by the gas industry are:

(a) The geographical distribution of consumers of ammonia does not coincide with that of the gas industry.

(b) Keen competition by large producers of ammonia seems certain.

(c) Production of synthetic ammonia on a very large scale by chemical manufacturers will probably lower production costs to the point that the smaller units of a gas plant will not be able to compete profitably.

7. From all the evidence considered it appears that the use of off-peak gas for the production of synthetic ammonia, while possibly attractive to certain gas companies because of peculiar local conditions, is not of general interest to the gas industry.

8. Market conditions for the disposal of methanol likewise appear unfavorable until such a time when gasoline shortage provides a motor fuel market.

An interesting technical confirmation of the feasibility of the Fischer process for low-pressure hydrocarbon synthesis was offered by Professor J. T. Ward, of Massachusetts Institute of Technology. Professor Ward, in discussing the Fieldner report, said that experimental work done in his laboratories proved that this Fischer procedure was workable, but also demonstrated that under many conditions trouble would be experienced with catalyst poisons. He expressed the opinion that this method of hydrocarbon synthesis was commercially feasible only if the problem of catalyst poisons could be satisfactorily solved.

Coal Survey Recommended

A subcommittee under the chairmanship of J. S. Haug reported on a proposed survey of gas and coke-making coals which had previously been referred to this group by the carbonization committee of the Association. The salient points of this committee's recommendation were:

Any chemical engineering industry must have the fullest possible knowledge of the source, quality, and behavior of its raw materials. The manufactured-gas industry does not yet have such knowledge regarding its major raw material, bituminous coal. It has been deemed important, therefore, that a fundamental and comprehensive investigation be made to survey the character and behavior of gas-making and coking coals and to establish procedures for testing which

will be significant as to the behavior of such coals in a commercial carbonizing plant.

The subcommittee considering this subject is unanimous in its opinion that extremely valuable results will inevitably be obtained from such an investigation. . . . The committee believes that the Association and interested Government laboratories should cooperate actively in the preliminary work. . . . It is believed that an adequate appropriation could be obtained through action of the American Gas Association in cooperation with other interested parties in bringing the need and importance of this work to the attention of the Secretary of Commerce and the Director of the Budget.

The subcommittee believes that the gas industry is justified in requesting this survey to be made by the national government, because of its fundamental importance in conserving the fuel resources of the nation through more efficient utilization of the various types of coal. The results of such an investigation by a disinterested and authoritative body would be of value not only to the gas industry but to other fuel using industries and the coal industry as well.

Manufacture of Water Gas of Low Specific Gravity

By Louis Stein and L. J. Willien

Gas Engineers of Northern States Power Company, Minneapolis, Minn., and Byllesby Engineering and Management Corporation, Chicago, Ill.

APPROXIMATELY 67,000 customers are supplied with gas in St. Paul and their requirements average 7,750,000 cu.ft. of 550 B.t.u. gas per day, with peak days exceeding 10,000,000 cu.ft. The major source of supply is coal gas supplied from coke ovens, at the rate of 5,500,000 cu.ft. per day for six months and 6,500,000 cu.ft. per day for the other half year. The gas has a calorific value of 550 B.t.u. and its variation in specific gravity is from approximately 0.38 to 0.43. The gas thus supplied is obviously insufficient to supply the entire requirements and it is, therefore, necessary to manufacture carburetted water gas to make up the deficiency.

Due to the location of the respective coal-gas and water-gas plants and the storage holders, as well as to the peculiar layout of the transmission and distribution systems, it is necessary to distribute straight coal gas to approximately 50 per cent of the territory served. The balance of the territory is served with varying mixtures of gases, at times being straight coal gas and other times straight water gas. There is, however, no sharp line of demarcation between the straight coal-gas district and the mixed-gas territory. The specific gravity of the gas formerly distributed in the mixed-gas district varied from 0.38 to 0.70, with all of the attendant service difficulties. It became necessary to consider what could be done to improve the gas service in the mixed-gas district without impairing the service in the coal-gas district. After giving careful consideration to all the possibilities, including probable investment charges and operating expenses, a decision was reached to attempt to manufacture carburretted water gas having a specific gravity low enough to burn satisfactorily in appliances adjusted for straight coal gas in the mixed-gas area.

Of the various gases that make up the composition of any type of manufactured gas there are only two which have a specific gravity of less than 0.97, hydrogen and methane. The specific gravity of hydrogen is so low it is apparent that the best way to reduce the specific gravity of carburetted water gas is to increase the percentage of hydrogen. The specific gravity of carburetted blue gas cannot be reduced by increasing the hydrogen from the blue gas reaction because of the CO or CO_2 formed at the same time. A perfect blue gas containing 50 per cent CO and 50 per cent H_2 will have a specific gravity of 0.52. The best way, therefore, to reduce the specific gravity of carburetted blue gas is to increase the percentage of hydrogen without a proportional increase in CO or CO_2, or to keep the percentage of hydrogen the same and reduce the percentage of CO or CO_2, or both.

Composition of Back-run Gas—The blue gas made during the back run usually contains more hydrogen than that made during the up run, as shown by the following analyses:

	Up run	Back run
CO_2	5.3	4.7
Ills	0	0
O_2	.2	.3
CO	38.8	38.1
CH_4	1.8	2.1
H_2	48.0	53.6
N_2	5.9	1.2
Sp.gr. calc	0.53	0.50

It is believed that the increase in the hydrogen content of the back-run gas is due to the oil that is in the carburettor and superheater when changing from the up run to the back run being carried back with the back-run steam through the fuel bed. A few years ago while making an investigation in a small water-gas plant, where one of the water-gas machines was equipped with a back run, oil was introduced during the back run just as an experiment to see what would happen. The oil, about 2½ gal. per M, was introduced into the top of the carburettor through the regular oil spray and a sample of the back-run gas was taken and analyzed. The results of this analysis were as follows:

CO_2	1.2	CH_4	18.1
Ills	1.8	H_2	57.5
O_2	.0	N_2	0.4
CO	21.0	B.t.u. calc.	476
Sp.gr. calc			0.39

The gas analysis clearly showed that the gas oil was overcracked, forming considerable H_2. This is not desirable in normal water-gas operation so the matter was not given further consideration until the situation in St. Paul presented itself, demanding lower gravity water gas.

Experiments at St. Paul—Since the water-gas machines at St. Paul were equipped with back runs it was a simple matter to experiment and see what would happen when introducing oil during the back run. The first experiment was made by introducing 12 gal. of oil during the back run over one coaling period. For the first tests a part of the oil was introduced through the spray in the top of the carburettor during the back run; the balance being admitted on the up run. The first experiments were made Oct. 28, 1926, at which time bituminous coal was used as a generator fuel. The resultant finished gas had a specific gravity approximately 16 per cent lower than that made in the ordinary manner.

Commencing Nov. 12, coke was used in place of coal as generator fuel because the temperature in the carburettor became too low simultaneously with excessively high temperature in the superheater. Furthermore, it was believed that a higher fuel-bed temperature could be maintained in the generator with coke, which would result in a better over-cracking of the oil. As a result,

it became possible to increase the amount of oil admitted on the back run, due to availability of a higher temperature fuel bed. The most interesting feature of the change was the resultant further reduction of specific gravity, the finished gas being about 20 per cent less dense than ordinary carburetted water gas.

Due to a continued unbalance of carburettor and superheater temperatures, and to difficulties encountered from lamp-black, it was decided to admit oil during the back run near the top of the superheater instead of in the carburettor. Consequently, several nozzles for this purpose were installed in the superheater. The results of experiments after this installation clearly indicated that this change was sensible. The only other changes which were made following experiments with oil nozzles in the superheater included enlargement of the overflow connections from the wash box to permit the introduction of a larger volume of water for lamp-black removal, and the conversion of a condenser to a lamp-black scrubber.

Operating Results—All through the winter 1926-27 this process was used on peak-load days. It was only necessary to use it on 11 days. The following is a comparison of the operating results with normal operation using both 100 per cent bituminous coal and 100 per cent coke.

	Introducing Oil on Back run Coke as Fuel	100 Per Cent Coal Normal Operation	100 Per Cent Coke Normal Operation
Make per hr. (M.cu.ft.)	227	150	184
Fuel per M. (lbs.)	21.89	29.00	29.69
Oil per M. (gals.)	3.61	3.08	3.28
B.t.u. per cu.ft.	552	557	583

These results show that introducing oil during the back run increased the capacity 23 per cent over normal operation with coke and 51 per cent over normal operation with coal. The fuel per M was reduced about 7 lb. and the oil increased about 0.5 gal. The increase in capacity and reduction in generator fuel was due to the increase in the amount of oil gas made per gallon.

Advantages Achieved—Approximately one year has elapsed since the foregoing experiments were begun and it may be said that with back-run equipped machines either straight coke or a mixture containing not to exceed 65 per cent bituminous coal may be used successfully for the production of low gravity water gas with oil admitted during the back run at the superheater.

The finished low gravity water gas has been distributed for some time, unmixed with any other gas, to consumers in the mixed gas territory with a very notable decrease in service difficulties as compared with previous conditions in the same district. In connection with the distribution of low-gravity water gas a series of tests were made to determine the maximum variation in gravity which the ordinary domestic appliance now used would burn satisfactorily.

On days when the supply of coal gas is insufficient for proper mixing, it is now standard practice to manufacture and distribute low-gravity water gas, a practice which has been found successful because it has improved the service to the customer. Furthermore, it has made unnecessary the investment of comparatively large amounts of money in other directions to effect the same result.

Operating Costs—In normal operation at St. Paul 100 per cent bituminous coal is used whereas when making the low-gravity gas 100 per cent coke was used. There is a differential of $3.48 between the price of coal and coke. The fuel and oil costs about 2 cents more per M for the low-gravity gas than normal operation. If the increase in capacity is taken into account and its effect on the labor cost considered the low-gravity gas costs about the same or if anything a trifle less. Even if it cost 5 or 10 cents more per M to make the low-gravity gas it has been found profitable to make it because it is a peak load proposition and the amount made in a year is a small proportion of the total sendout.

BY INTRODUCING about 1½ gal. of oil per M during the back run it has been possible to reduce the gravity of a 550-B.t.u. water gas from 0.70 to between 0.50 and 0.55. This gas has been successfully used in a district ordinarily supplied with 100 per cent coke-oven gas where the gas appliances are adjusted for coke-oven gas.

Much better results are obtained when using 100 per cent coke or a mixture of coke and bituminous coal as generator fuel than when using 100 per cent bituminous coal.

With 100 per cent coke as generator fuel there is an increase of about 25 per cent in the capacity of the water-gas machine as compared with normal operation with coke and an increase of 51 per cent when compared with normal operation with 100 per cent bituminous coal. This is a great advantage because the low-gravity gas is needed only during times of peak loads. If the capacity of the generating equipment can be increased materially at such time it means a considerable saving in capital expenditure.

Even if gravity is not an important factor it is believed that with coke, by introducing oil during the back run and using a blow run the inerts can be kept below 15 per cent and a further increase of 10 or 15 per cent in capacity obtained.

Indications are that, from an operation standpoint, the best place to introduce the oil is at the top of the superheater instead of at the top of the carburettor.

The experience at St. Paul so far has been limited to an 11-ft. water-gas machine equipped with a back run and automatic control and to making a 550-B.t.u. gas. What results can be obtained on a machine equipped with a pier, automatic charger, revolving grates, or when making a lower B.t.u. gas, we are in no position to say because it has never been tried. It is believed, however, they would be an advantage. It is also believed that as the B.t.u. of the gas is lowered that the gravity will be lowered also. In lowering the B.t.u. it would probably be best not to change the amount of oil used on the back run but reduce the amount used on the up run. This would increase the proportion of back-run gas in the finished gas and should reduce the gravity.

The possibilities of this process seem unlimited and apparently the surface has only been scratched.

Manganese as a Fertilizer

L. P. Miller recently reported certain experiments on tomatoes grown in sand cultures with alkaline water supply, which indicate that the addition of small amounts of manganese sulphate restored the usual green color to the plants which had previously shown chlorotic mottling in the leaves. This author concludes that manganese is an effective cure for this diseased condition.

Locating the Chemical Plant

By R. L. Kraft
Technical Service Co., New York, N. Y.

LOCATION of a chemical industry, as for any industry, is determined by a careful analysis of the five major factors: Raw materials, market, transportation, labor and power. After the relative importance of each of these factors is diligently studied with due regard to present conditions and future developments, a conclusion will be reached which will confine the industry under consideration to a certain limited area or perhaps to several such limited areas. The problem now resolves itself into choosing a plant or site in one of the areas. It is the solution of this problem which is particularly difficult for the chemical manufacturer due to the fact that there are so many special conditions characteristic of the industry which have to be taken into consideration.

There are many handicaps peculiar to the manufacture of chemicals. The chemical industry's struggle for existence is frequently intensified by adding the factor of unfavorable environment, i.e., unsuitable location. This article, by a chemical engineer of broad experience in solving plant location problems, stresses the importance of adequately considering those unusual factors specifically affecting chemical industry.

Chemical plants are not usually looked upon as desirable neighbors. They may be regarded as a source of danger from possible explosion, or, because of fumes, as a detriment to the health of the community and to its vegetation. The newspapers have done much to foster this unfriendly attitude. Every chemical accident is given considerable space in the news columns because such incidents can be so easily worked up into dramatic "feature" articles. The result of this propaganda against the chemical industry has been that many communities have passed ordinances against chemical manufacturing or certain classes of chemical manufacturing. For example: Jersey City will not permit the manufacture of lacquers, the City of Newark prohibits the manufacture of fireworks. Before locating in any particular locality, it is necessary, therefore, to determine whether any such ordinances are in effect. It is also advisable to ascertain whether the attitude of the community is particularly unfriendly to chemical manufacturing. If this is the case, it is good policy not to locate in such a locality even though no restricting ordinances are in effect at the time. Such information can usually be obtained from the local Chamber of Commerce or Board of Trade or by making inquiries at other plants in the locality.

Most large cities and many of the smaller towns are zoned, i.e., divided into residential, business and unrestricted districts. A distinction is often made between so-called light manufacturing and heavy manufacturing. Chemical plants generally must locate in heavy or unrestricted zones. Zoning regulations must, therefore, be carefully investigated. Where such regulations are in force, a map is usually published outlining the various zones. As the boundaries of these zones are subject to small changes at frequent intervals, care must be taken to ascertain that the zoning map has been corrected to date. An unrestricted zone may even be slowly changing in character due to encroachment of residences, to parks or to other civic developments.

If the industry to be located is in any way hazardous or is likely to be a nuisance due to the possibility of fumes or objectionable odors escaping, a site should be chosen which is far enough away from houses and public institutions. This is a precaution which is frequently overlooked and one which will cause endless trouble and expense when not observed. Several years ago a plant located in a town near Newark, N. J., was manufacturing a dye intermediate and occasionally permitted a small amount of sulphur dioxide to escape into the atmosphere. In the immediate vicinity of the plant were a number of homes. The residents got together and at a town meeting convinced the town officials that the fumes from the plant had injured their health and ruined their gardens, although the amount of sulphur dioxide which escaped was insufficient to have any detrimental effect whatever. In accordance with instructions, the sheriff of the town closed the plant for several months. This suspension of operations, occurring as it did at a particularly busy time, meant a serious financial loss for the plant.

Another chemical manufacturer in Brooklyn, whose plant was surrounded by houses, manufactured a product which dusted freely, and this dust frequently escaped. When the dust came in contact with the wash on the clothes lines of the neighboring residents, brown spots would result. In order to continue manufacturing, it was necessary for this manufacturer to pay his neighbors a certain amount every week for damages to their wash. One of the neighbors sold his house and part of the inducement offered the purchaser was the fact that he would be able to collect weekly damages from the chemical plant. After the sale was consummated, the new owner actually applied for his share of the weekly damages.

The gypsum industry has been particularly bothered by objections to its sometimes excessive dust. Examples describing annoyances, interruptions in operations and serious financial losses incurred, due to the plant being

situated too close to a residential district, are unfortunately familiar to most chemical manufacturers.

If there are other plants in the immediate neighborhood of a site under consideration, it would be advisable to find out what products these plants are manufacturing and by what methods. For example an adjoining plant manufacturing a highly flammable product would affect the insurance rate if the buildings were sufficiently close. The neighboring plant may also give out dust or fumes which may affect the product to be manufactured.

A CHEAP and plentiful water supply is usually an important asset to a chemical plant. If large quantities of water are required, a site should be chosen where a deep well or perhaps an artesian well may be drilled at a reasonable cost if these are not already on the property. In investigating this problem considerable help may be obtained by consulting the state geological survey which can furnish valuable information regarding subterranean waters in every district. Information regarding the kind of soil and the depth of the subterranean water may also be obtained from this source. An inspection of the wells in the vicinity will give a good indication of the depth necessary to drill on the site under consideration. The quantity of water taken from the neighboring wells may affect the amount of water available. The quality of the water in neighboring wells will give a good indication of the water which can be expected. This latter consideration is particularly important where process water is required.

Disposal of waste liquors and waste products is frequently a problem for the chemical plant and, therefore, must be given serious consideration in locating a site. If a sewer is in the street adjoining the property, the amount of liquor to be disposed of should be estimated and the size of street sewer checked to determine whether it can take care of the liquor. If the waste liquor is acid or alkaline, contains solids, or has other objectionable features, it is advisable to learn from the local authorities whether the disposal of such liquor in the sewerage is permissible.

Chemical plants often dispose of their waste by locating on a stream, river or tidewater. Disposal by tidewater is often satisfactory if there are no bathing beaches nearby. Disposal of waste into a stream or river is not so satisfactory as there is a growing tendency in various parts of the country to stop such pollution by industrial wastes.

A plant located at the headwaters of the Rahway River disposed of a chemical effluent in the river. The City of Rahway, located about five miles below, had trouble with the quality of the drinking water obtained from the river. Tests were made and after considerable investigation, the impurities were traced to the waste liquors from this plant flowing in the river. To overcome the objections of the City, the plant had to treat the waste liquors chemically and filter them through a sand filter before permitting them to flow into the river. Occasionally there would be trouble with the treatment and some of the untreated material would get into the river. The City, making tests periodically, however, would detect the passing of untreated material in the stream and would order immediate correction. This method of waste disposal therefore proved to be expensive and a constant source of annoyance.

The Passaic River in New Jersey, which at one time was noted for its scenic beauty, had been converted into practically an open sewer. The water and shore line was black due to the disposal of all sorts of waste products into the stream by the large number of industrial plants situated on its shores. In the Summer, due to the decomposition of the waste material, the odor was practically unbearable. Finally the communities in the vicinity of the river, by a united effort, brought about the installation of a giant industrial sewer parallel to the river. An ordinance was passed prohibiting the disposal of waste material in the river and requiring connection with the trunk line sewer for waste disposal. The river is now slowly regaining its old-time beauty, but will take many years before it fully recovers from the effects of the large-scale pollution it had to undergo for so long a period. The solution in the case of the Passaic River, although brought about at a tremendous cost, appears to be satisfactory, and was warranted because of the large number of industries affected. Such a solution would not be practical in less populated areas.

Another method of waste disposal is by seepage through the ground. If such a method is to be used, soil tests should be made to determine whether the soil is porous enough to permit the disposal of considerable quantities of liquor without accumulation. It is also advisable to check the topography of the area to determine where the liquor will seep in order to avoid trouble from neighboring plants or the local authorities. Towns lower down the valley may draw their water supply from the drainage shed upon which the plant is located. Neglect of this factor has caused several plants to be shut down although they were allowed to operate during the war.

Occasionally it has been found practical to locate a plant adjoining another plant which has the facilities to work up the waste product of the former to advantage. Recently a small plant making dyestuffs had the problem of disposing of a weak acid which could not be put into the city sewers because of its corrosive action. This plant finally located next to a large chemical plant. An arrangement was made whereby the weak acid was piped to the larger plant which could economically work up the acid.

In choosing a site the characteristics of the ground should be carefully investigated to ascertain whether it is virgin or filled-in ground. Borings should be made to determine whether piling is required, and if so, to what extent. Piling adds considerable to the foundation of a building, and such land even though purchased cheaply may prove to be very expensive.

The availability of public utility gas and electricity is almost always an asset to any plant, as these services can usually be purchased at a lower cost than by operating private units in the plant. Even when gas or electricity are made in the plant, an outside source is of considerable value for emergency purposes. Often gas and electricity are available, but the mains or lines may not be large enough to meet requirements of the plant. The cost of increasing the size of the mains or lines may be excessive where a considerable distance has to be covered. Public utilities are usually unwilling to assume part or all of the cost unless the probability of other large consumers locating in the vicinity in the near future is exceptionally favorable.

After the site has been chosen and the plant installed, it is good policy for the executives of the plant to take a lively interest in the local community. Such interest can be expressed by joining the Chamber of Commerce or Board of Trade, and working on the various committees. Local politics should also be given much consideration. Good will developed in this way may prove to be a valuable asset in time of trouble.

Flexibility of Equipment Produced a Versatile Engine Laboratory

By D. P. Barnard, 4th
Standard Oil Company of Indiana, Whiting, Ind.

THE ENGINE laboratory of the Standard Oil Company of Indiana was built in 1925 at the company's refinery at Whiting, Ind. The principal object in establishing this laboratory was to furnish facilities for research of a mechanical nature, mainly in connection with automotive equipment. Inasmuch as this work is intimately connected with both the refinery and sales division, the laboratory is particularly fortunate in being located at the refinery and at the same time only seventeen miles from Chicago's loop district and the company's headquarters.

The work carried out at the laboratory ranges from pure research to the education of field engineers and the development of sales demonstrations. Among the specific experimental problems which have been investigated are the testing of motor fuels for their detonation characteristics, starting volatility tests at low temperatures, tests on fuel "dopes" for carbon removal and knock suppression, lubrication problems such as oil consumption, crankcase dilution, carbonization, cranking and circulation characteristics at low temperatures, fundamental research on lubrication, transmission lubricants, demonstrations of products in service for the sales division, education of field engineers and the investigation of a number of miscellaneous sales and service engineering problems on special engines or machinery.

Fig. 1—Exterior of Engine Laboratory of the Standard Oil Co. at Whiting, Ind.

The laboratory consists of a concrete building having a total plan 50 by 70 ft., which includes a main room 30 ft. wide and 70 ft. long and a 20-ft. bay which provides space for an office, chemical laboratory, shop, storeroom, lavatory and a compartment for the motor-generator set. A general view of this building showing the entrance to the low temperature room is shown in Fig. 1.

The low temperature test room is located at the southeast corner and the 100-hp. General Electric dynamometer is installed next to it. This machine is of the double-ended type and can be connected either to the equipment under test in the "cold" room or to an engine on the stand at the other end. Sufficient space between the dynamometer and "cold" room wall has been left to permit the installation of a reduction gear for cranking tests, or in case it be necessary to absorb more power than the machine can handle alone, a hydraulic brake can be used to "back up" the electric dynamometer. This dynamometer is used for all cold room work and engine tests requiring accurate power measurements such as tests of carburetor and manifold equipment, fuel consumption and other performance characteristics.

Similar work may be carried out with the 90-hp. Froude hydraulic dynamometer which is used as an auxiliary test plant, and which is shown in Fig. 3 together with the main test unit. The hydraulic dynamometer possesses several advantages to a laboratory engaged in a great variety of work. The simplicity and lightness of its moving parts adapt it well to high-speed work and, as a rule, the failure of a bearing or rod at high speed will not be accompanied by serious damage as would be the case with an electric dynamometer having a heavy armature. The rotor of the hydraulic machine weighs less than 50 lb. and can be stopped in a few revolutions from 4,000 r.p.m. without damage to the couplings. Furthermore, its independence of an exciting current supply renders it very satisfactory for those tests where continuous operation for many hours is desired. It can be readily moved about as it is relatively light and only requires two hose connections to care for water supply and discharge. However, as it cannot be used as a motor, friction power or starting torque measurements are impossible and the electric machine must be employed for this purpose. The dynamometer is also very useful in starting large engines.

In addition to the two cradle dynamometers described, a 40-hp. block test machine is used for general rough service tests, oil consumption observations, and the breaking in of new engines.

The success of the low-temperature test room as installed will probably warrant a fairly detailed description of this rather unusual installation. This room is about 9 by 11 ft. and contains an engine bedplate large enough to carry any conventional engine except those of the radial type. The room itself is made of $\frac{1}{2}$-in. steel plate, heavily braced and lagged with 10 in. of ground cork. The only entrance is by the outside door, this precaution being taken to prevent damage to the main laboratory in

case of an explosion. All engine controls are brought outside to a panel located conveniently to the dynamometer control panel and a 4-in. diameter port enables the operator to listen satisfactorily to any source of noise from the cold room. With this arrangement there is little incentive to remain in the cold room during tests as it is more convenient to stand outside in comfort than to handle controls in an iron box at —20 deg. F.

Refrigeration is supplied by a 50-ton absorption type machine expanding through about 4,000 ft. of 2-in. pipe suspended in the upper half of the 14-ft. high room. This amount of refrigeration seems disproportionately large at first sight, but the rapidity with which the temperature can be lowered and the rigidity with which it can be controlled have more than justified the use of oversize equipment. It is readily possible to bring the room from 80 deg. F. to —20 deg. F. in a few hours, and a continuous temperature of —30 deg. F. has been maintained for several days within a degree with the outside air at 80 deg. F. It is even possible to maintain zero temperature with an engine running lightly. This room has been exceptionally useful and two years of continuous experience have indicated no preferable change unless it be the substitution of I-beams fastened to the surface of the floor in place of the cast bed plate which requires careful attention under these conditions to prevent rusting.

A considerable amount of time has been spent in studying the viscosity characteristics of motor oils at low temperatures and a viscosimeter has been developed which permits viscosity determinations down to sub-zero temperatures. It consists of a modified Saybolt instrument fitted with its own small ammonia refrigerating plant, means for applying carefully regulated air pressure to induce flow, and thermocouples for accurately determining the temperature of the oil flowing through the metering capillary. The amount of flow is determined by weighing the samples caught in bottles in a receiving rack below the capillary. This equipment is illustrated in Fig. 2.

The examination of motor fuels for their detonation characteristics is an important part of the engine laboratory's program, several thousand tests of this nature having been made up to the present time. The test plant

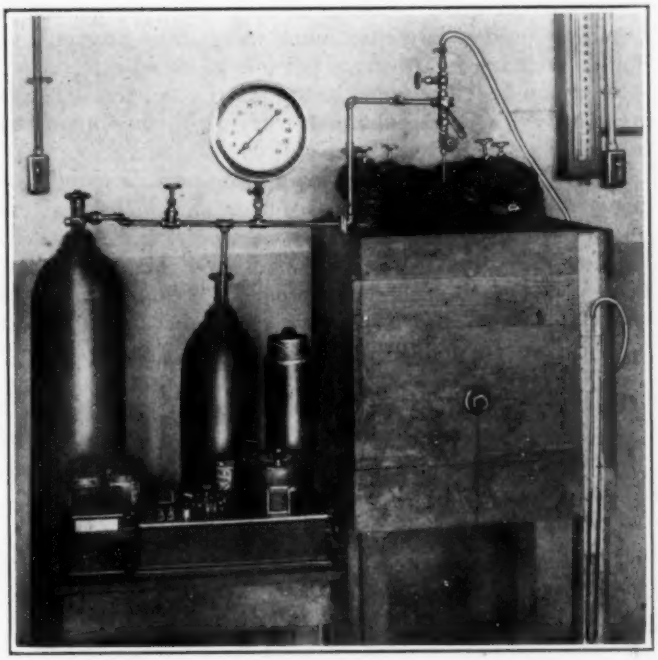


Fig. 2—Low Temperature Viscosity Apparatus

used for this purpose is shown in Fig. 4 and consists of a single-cylinder $2\frac{7}{8}$-in. by 4-in. engine connected to a 15-hp. electric cradle dynamometer. The engine has a compression pressure of about 125 lb. gage and is completely fitted with facilities for rigidly controlling all important operating characteristics. Dial type thermometers are used to measure water, mixture and oil temperatures, and both fuel and air are metered as a part of each test. As a rule, satisfactory precision can be obtained simply by noting the power output of the engine when detonating to a moderate degree under fixed conditions of speed, temperature, and mixture strength and comparing such power observations with those obtained by using fuels of known detonation characteristics such as may be made by adding varying amounts of tetraethyl lead. The Dickinson bouncing pin indicator works very well in this engine and affords a somewhat more accurate determination of the "detonation point" than can be made by the ear alone, though it requires considerable attention

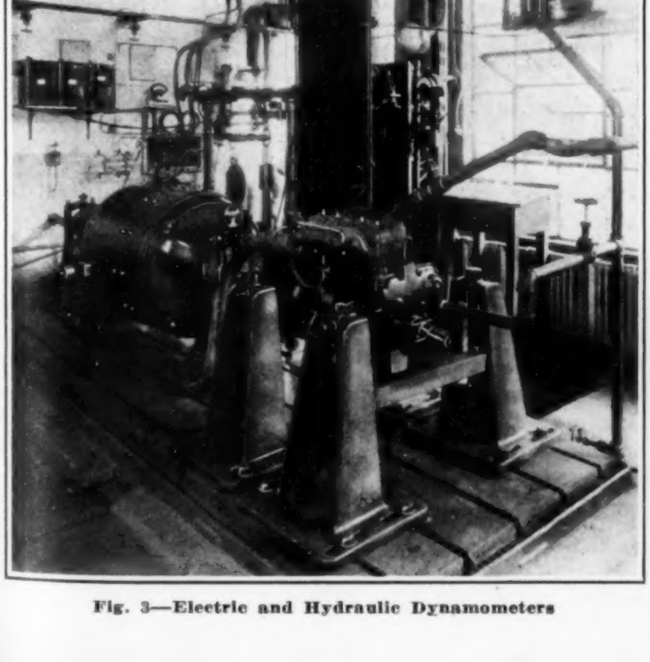


Fig. 3—Electric and Hydraulic Dynamometers

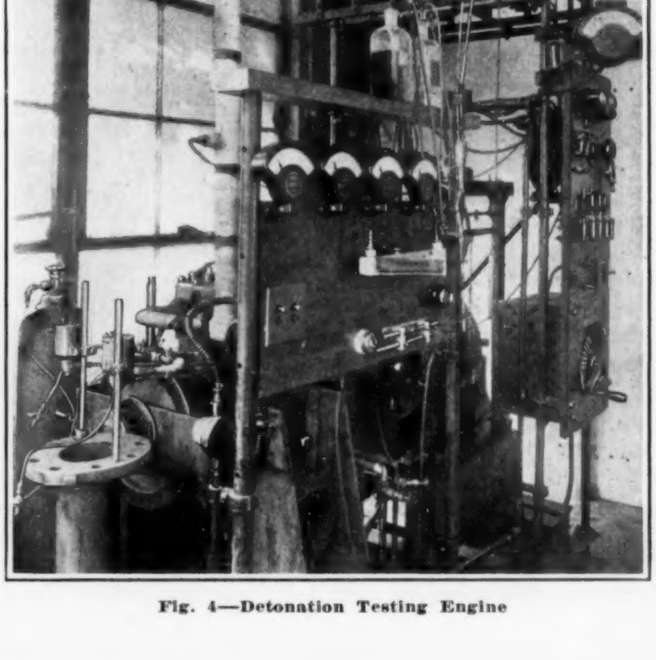


Fig. 4—Detonation Testing Engine

to keep it in good working order. This equipment is regularly used where maximum accuracy is desired. A double float bowl carburetor permits of rapid comparison between the test fuel and the standard. All test samples are matched against standards varying in increments of 0.2 cc. of tetraethyl lead per gallon.

Exhaust gases from the various engines are conducted away by means of an 8-in. main through which a current of air is continually drawn by means of an exhauster. This main has two intake stacks and one exit stack. The very slight suction in the main (less than 0.5 in. of water) effectively prevents the leakage of smoky gases into the test room, and up to the present time no appreciable pulsation effects have been noted.

One of the most important pieces of equipment in this laboratory is a well-equipped machine shop which is in charge of a competent machinist. This shop has justified the expense of its installation many times, as there is always a large amount of fine machine work to be done in a laboratory of this type. The type of work done in the shop varies from the making of special carburetor jets, cylinder heads, etc., to the fitting of dynamometer couplings. In fact, construction of a special engine for aircraft engine cylinder research has just been completed.

At the present time the personnel of the laboratory consists of five research men, a machinist, and a mechanic who does the bulk of the "monkey wrench work" such as engine repairs and installation, and who assists in many of the engine tests.

Large Pressure Vessels Successfully Welded

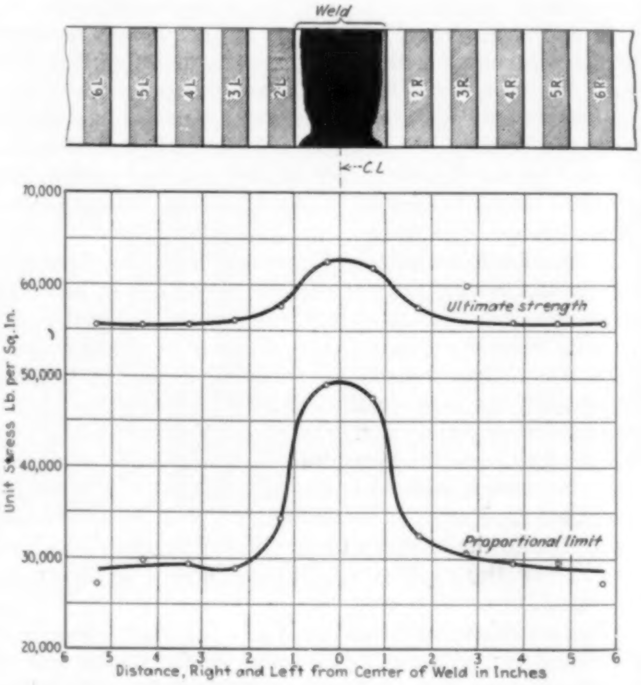
LABORATORY tests, confirmed by operating experience in several typical fields, indicate that welded vessels are successfully withstanding the severe conditions of pressure, temperature and corrosion encountered in chemical engineering operations. In a recent summary of developments in this field, T. McLean Jasper, of the A. O. Smith Corporation, Milwaukee, Wis., points out that methods of joining metals must be improved to produce the designs most suited for use under the high pressures and temperatures now being demanded. Welding offers a means for producing vessels of size and shape hitherto unattainable by any other method and in metals of different compositions to suit the needs of various special industries. It has been thought that welding was associated with brittleness in the weld material and over-heating of the metal adjacent. It is now known that these are only a phase of welding and can be eliminated entirely by proper observation of the principles of welding technique.

Welded oil-cracking stills were among the first important installations of this type. One manufacturer has today in the field over 500 arc-welded vessels of large size working at temperatures up to 900 deg. F. and at pressures up to 600 lb. per sq.in. at those temperatures. These vessels vary in weight from 100 to 230 tons. No service failure in those arc-welded vessels has been reported.

The largest high-pressure arc-welded vessel ever built is working at 900 deg. F. and weighs over 260,000 lb. A vessel is under construction by arc-welding which will weigh, when completed, 380,000 lb. and will operate at a temperature of 900 deg. F. The size and weight of such equipment are curtailed only by the facilities for shipping and erection.

The tests here presented apply to the metal used in the fabrication of vessels. They apply to carbon steel having a yield point of from 30,000 to 35,000 lb. per sq.in. and an ultimate strength of from 55,000 to 60,000 lb. per sq.in. when metal from 2 to 6 in. in thickness is considered.

The figure below represents test results on a series of slabs cut from a 2⅝-in. plate which had been made by arc welding two pieces together. The slabs were cut parallel to the weld and so arranged that the results represent the strength values at each ½-in. point on either side of the center of the weld and for a distance of 6 in. from the center of the weld.



Results of tests and location of test specimens of weld material and adjacent metal

It will be noticed that the weld strength is about 12 per cent greater than the plate strength and that the strength at a point immediately adjacent to the weld is stronger than the plate material. This is due to the heat-treating effect of the welding process. These results are consistently found when the correct balance is obtained between the metal joined, the weld material and the condition governing the welding process.

Long temperature tests show the weld material stronger than the plate material for all temperatures tested which range up to 900 deg. F. Corrosion results from high-temperature and high-pressure vessels using very corrosive crude and gas oils also show that the weld is no more corrosive than the metal joined. Laboratory corrosion results also show that the metal used in the process described above is less corrosive than the ordinary 8 to 12 carbon steel used in many vessels.

Results similar to those presented are being obtained in the joining of many non-corrosive and special alloy steels.

Determining Heat Consumption for Caustic Dehydration

Even where the data are not sufficient, calculation may save costly experiments

By Gösta Angel
Bohus, Sweden

IT RECENTLY fell to the lot of the author to determine the best and most economical method for dehydrating caustic soda and potash solutions of an initial concentration of about 50 per cent. The question had arisen as to whether this could be better accomplished through the use of electric heating or by means of some form of direct fuel; and whether the use of vacuum dehydration would justify its greater investment charge over that incident to the atmospheric process.

Since there were but two possible methods of determining the unknown in this problem, the heat requirements for the various conditions; the one to measure the quantities actually upon a plant scale; the other to calculate them, the answering of the question proved to be of considerable difficulty. The first method required large expenditures of both time and money, while the second was found to be sadly lacking in data upon which to predicate the calculations. It was found, however, that through the use of a number of physical chemical considerations, that the second and cheaper method could be utilized. That the reasoning employed was sound has

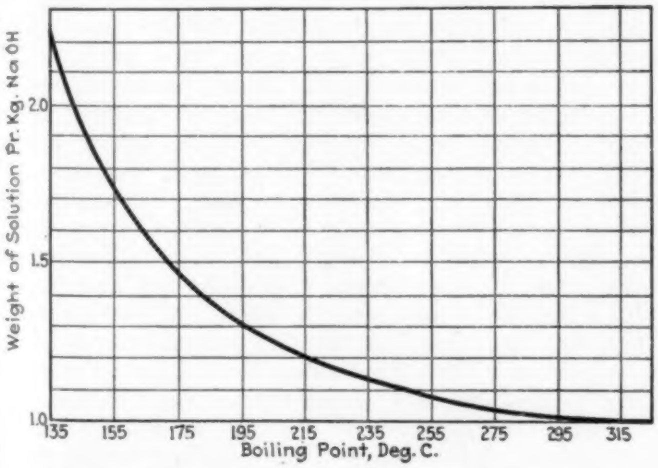


Fig. 1—Boiling Points of Caustic Soda Solutions According to Gerlach

been later demonstrated in the installations built as a result of the investigation. And as the means by which the results were obtained are applicable in other cases, it may be worth while to reproduce them here.

It is well known that when a substance is dissolved in a liquid, that the boiling point of the liquid is increased; and that the lower the molecular weight of the dissolved substance, and the higher the concentration and degree of dissociation, the greater is this increase. As would be expected, for these reasons, solutions of the caustic alkalis have extraordinarily high boiling points which increase rapidly as the concentration of the solutions progresses. Figs. 1 and 2 are taken from the work of Gerlach and show graphically the boiling points at various

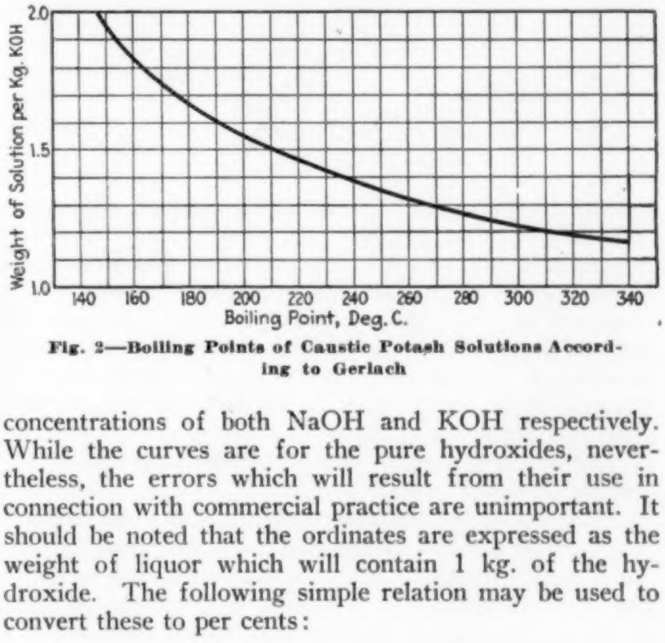


Fig. 2—Boiling Points of Caustic Potash Solutions According to Gerlach

concentrations of both NaOH and KOH respectively. While the curves are for the pure hydroxides, nevertheless, the errors which will result from their use in connection with commercial practice are unimportant. It should be noted that the ordinates are expressed as the weight of liquor which will contain 1 kg. of the hydroxide. The following simple relation may be used to convert these to per cents:

$$\text{per cent caustic} = \frac{100}{\text{ordinate}}$$

We will first take up the case of the dehydration of NaOH. The calculations for KOH may then be performed in an exactly analogous manner.

The heat requirements for the dehydration of the caustic may be split into the following factors: Heat needed is

1. That to heat the solution to the boiling point for that concentration.
2. That to heat the solution from the initial to the final boiling point.
3. The heat of dissolution to effect the separation of the solid from the solute.
4. The heat of evaporation of the water.

The first item would be easy to evaluate if we were permitted to consider this an ideal solution and assume that the specific heat were equal to the sum of the specific heats of the components. We know, however, that the

actual heat capacity of the solution is less than the sum, and that it increases with the temperature. We are able to avoid an unwarranted assumption at this point by the use of a device which will be later explained.

The second item is open to the same difficulty as the first, and is in addition complicated by the fact that the specific heat also varies with the concentration. As we shall see later, however, this difficulty may also be circumvented. The third point, on the other hand, presents an obvious solution. The heat required to separate the water from the NaOH is exactly equal to that given out in the reverse process of dissolving the solid in water. And similarly, where there is no change in the state of

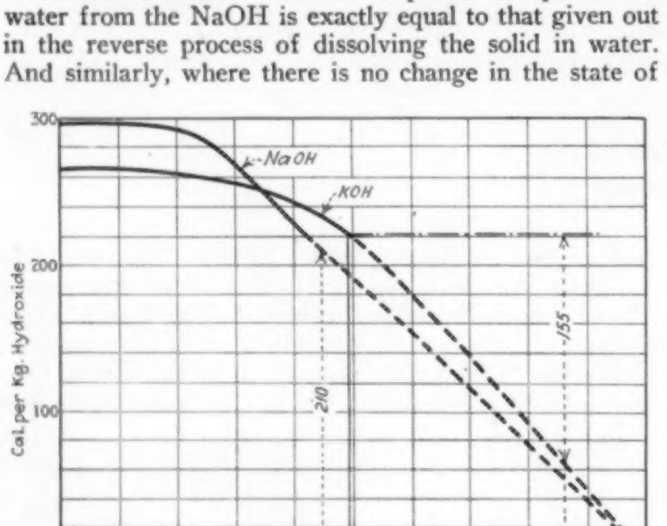


Fig. 3—Heats of Dilution for NaOH and KOH Solutions

aggregation of the hydroxide, as when fused caustic is dissolved in water, the heat evolved is equal to that required to effect the opposite process. Thomsen has determined the heats of dilution for both caustics for a number of concentrations at 18 deg. C. As is later explained, these results may be made to fit our purpose. The data are given in Fig. 3.

The last item may, of course, be easily calculated with the aid of steam tables.

Since we do not, unfortunately, have any data regarding the heat capacity of the solution in question, this lack must be side-stepped. A simple theoretical case will make the method clear. If we have a perfectly insulated chamber from which no heat may escape, and which is so large that no increase in pressure will occur if a small amount of steam is formed, then we may heat an amount of caustic liquor from 0 deg. C. to the boiling point, and evaporate off the water. As a result, we will have steam and fused caustic at the final boiling temperature. If we now take away the heat and so arrange that the caustic and steam cool down separately to 0 deg. C. we will have water and solid hydroxide as end products. When the final temperature has been reached, then we may allow the two components to recombine, after which we cool the resulting solution to 0 deg. C., our original starting temperature. The heat which was given up during the two cooling stages is now examined and found to consist of the following: latent heat of both caustic and steam, sensible heat of both caustic and water, and the heat of solution of the solid caustic in the water. But since the last process occasioned a change of aggregation of the caustic in the separation of the molecules, an energy requirement equal to the latent heat of the fused caustic is subtracted from the total heat of dilution. As this is numerically equal to the first heat given up when the caustic originally solidified, we may simply cancel the two terms. Now upon observing that the solution is again in the original state as at the start of the experiment, and recalling that the process was assumed to be adiabatic, we find that the heat which is left is exactly that which we first added to the process, and that consequently the cooling process in which the components were separated is equivalent to the original dehydration of the solution. The result of this discovery is that we may calculate the necessary heat for dehydration for the two components, NaOH and water, separately. The method of procedure now resolves itself into four simple steps: the various heat components are:

1. That to raise pure NaOH from 0 deg. to the fusion temperature.
2. Total heat of saturated steam at the final boiling point (fusion temperature).
3. Heat to superheat the steam so formed.
4. Heat of dilution of the NaOH.

The mention of superheat in item 3 may seem unwarranted. This is seen to be correct, however, when the circumstances are examined. The final boiling point of the solution at atmospheric pressure is, by Fig. 1, 315 deg. C. Obviously, since the steam formed at this temperature is saturated before leaving the solution, it must expand and absorb additional heat which appears as superheat on leaving the solution, in order that its temperature may remain that of the solution. The same is true at each intermediate boiling point.

As a specific example to illustrate the relations thus obtained, let us assume that it is desired to dehydrate a quantity of 44.7 per cent solution of NaOH containing 1 kg. of the hydroxide. Fig. 1 shows the boiling point of this solution to be 135 deg. C. Steam is evolved at this temperature and at atmospheric pressure with a superheat of 35 deg. The energy required for this superheat is easily calculated from the steam tables by taking the difference in total heat between superheated and saturated steam at this temperature. The difference between 655.5 Cal., the total heat for the superheated steam, and 650.2 Cal., that for saturated steam, which equals 5.3 Cal. represents this energy per kg. of steam. The heat necessary to produce 1 kg. of saturated steam at this temperature is 514.6 Cal., and the total to evaporate 1 kg. of water from a 44.7 per cent solution at 135 deg. is 519.9 Cal. However, as water is removed the temperature increases, and with it the heat of expansion, or that to produce the superheat. Simultaneously, the latent heat of water decreases, and also less water is being evaporated. Consequently, the rate of heat consumption for expansion does not vary materially throughout the process. Then, by dividing the boiling point curve into intervals we may use an average temperature value for each interval and obtain for each the average heat of expansion. A summation of the quantities for the entire range will therefore give the heat necessary for this part of the process.

One such interval is calculated as follows: The weight of the caustic liquor at the start is 2.233 kg. for 1 kg. NaOH. At a point where the boiling temperature is 10 deg. higher, 145 deg., the weight has been decreased to 1.939 kg. Thus, at an average temperature of 140 deg., 0.294 kg. of water has been evaporated and expanded. As the specific heat of steam may be taken as 0.48, the heat of expansion is $0.294 \times 0.48 \times 40 = 5.6$ Cal. A similar computation is made for each 10 deg.

interval. The sum of the superheats for all the various intervals amounts to 46.0 Cal.

To obtain the heat required for the saturated steam we note that a total of 1.233 kg. of water is evaporated. Since the total heat at atmospheric pressure is 639 Cal., we find that the heat content of saturated steam per lb. of NaOH is 1.233 x 639 = 787 Cal.

By extrapolating in data of Blümcke we find that a fair average specific heat for solid NaOH between 0 and 315 deg. is 0.9. The heat content of 1 kg. of NaOH at the fusion point is therefore 0.9 x 315 = 284 Cal. And from Fig. 3 we find that the heat of dilution of NaOH to 44.7 per cent is 210 Cal. at 18 deg. No appreciable error will result if we assume that this figure is also correct at 0 deg. We are now in a position to summarize the results:

Heat content of 1 kg. NaOH, 0.9 × 315	284 Cal.
Heat content of saturated steam, 1.233 × 639 =	787 Cal.
Superheat of the steam	46 Cal.
Heat of dilution per kg. NaOH at 0 deg.	210 Cal.
Total heat consumption per kg. NaOH	1,327 Cal.

In a similar manner the heat requirements for other initial concentrations of caustic soda solutions may be calculated. Such a series of results have been plotted in Fig. 4. This may be used, not only to determine the amount of heat necessary for dehydration from any concentration, but also to give the heat consumption between any two concentrations.

By the use of the data in Figs. 2 and 3 for caustic potash it is no more difficult to make a series of calculations for the concentration and dehydration of KOH than it was for NaOH. In this case 49.4 per cent caustic potash solution is concentrated to 86.2 per cent, the last point determined by Gerlach. The boiling point at this concentration is 340 deg. The average specific heat of the KOH during the temperature range is about 0.65.

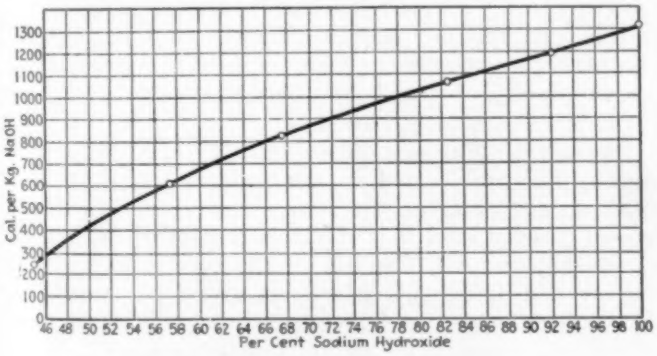


Fig. 4—Heat Consumption in Concentrating Caustic Soda Solutions

This curve gives the heat required to concentrate 44.7 per cent solution to any point up to and including complete dehydration.

The weight of solution corresponding to the boiling temperature, 340 deg., is 1.16 kg. per kg. KOH. The summarized results are consequently:

Heat content of caustic potash, 1.16 × 0.65 × 340 =	256 Cal.
Heat of saturated steam, 0.86 × 639 =	550 Cal.
Superheat of steam	44 Cal.
Heat of dilution per kg. KOH at 0 deg.	155 Cal.
Total heat consumption per kg. KOH	1,005 Cal.

As in the case of caustic soda, the calculations have been extended to give sufficient data to enable Fig. 5 to be plotted. With this information available, it was then possible in the original investigation to consider the relative advantages of various methods of supplying the heat necessary for the dehydration. In actual practice in using coal, 0.5 kg. is necessary per kg. of caustic soda under the conditions of our first example. Assuming a calorific power of 6,000 Cal. per kg., and in rough figures, a theoretical requirement of 1,400 Cal. per kg. of caustic, it is found that the efficiency of the process is only 1,400 ÷ 3,000 or 46½ per cent. This is principally due to the high furnace temperature carried and the resulting high losses from radiation and flue gases. Electric furnaces, on the other hand, may be made with an

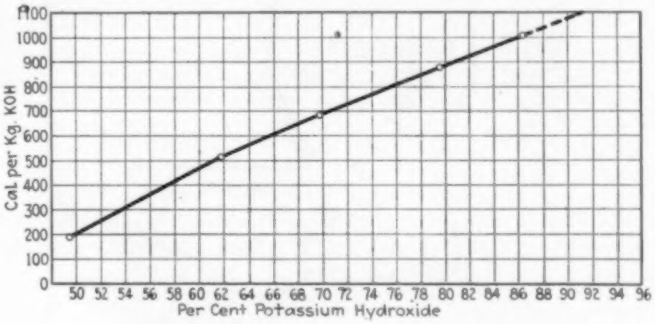


Fig. 5 — Heat Consumption in Concentrating Caustic Potash Solutions

Heat required to raise the concentration of 49.4 per cent solution to any higher value is shown.

efficiency as high as 85 per cent. The coal requirement, in kw.-hr. equivalent to electrical energy, is 3.48 kw.-hr. per kg. NaOH as compared with 2.0 kw.-hr. for electricity. In this particular instance, the actual cost for coal per kg. dehydrated was 26 per cent more than the cost of using electric power. In addition, labor and maintenance costs on the electric pots were very appreciably less. Both processes may also be considerably cheapened by using the steam given off to preheat the caustic liquor. In the case of both NaOH and KOH there is sufficient heat in the steam to preheat the feed to the boiling point. This is actually done in connection with electric dehydrating pots at Elektrokemiska Aktiebolaget, Bohus, Sweden.

Recently a number of plants have employed vacuum kettles for the dehydration. The reduction in heat necessary is surprisingly small as it is only about 4 per cent. This results from the fact that of the four divisions of the heat requirement which we have examined, neither the heat of dilution nor the superheat vary appreciably, while the reductions in caustic and saturated steam heat content are both slight. When the dehydration is carried out at a pressure of 155 mm., the reduction in the former is 37 Cal. and in the latter 20 Cal. or a total of only 57 Cal. per kg. of NaOH dehydrated. In the case of electrically heated apparatus, the only decided advantage gained by vacuum operation is the longer life of the pots due to the reduced temperatures. On the other hand, where coal firing or other direct combustion means are used, the temperature reduction results in such a decrease in stack and radiation losses, that the improvement may be as high as 20 per cent. The use of vacuum kettles is therefore strongly recommended in cases where electric heating cannot be used. But where power is cheap, as it is in Sweden, fuel heated kettles are a poor investment.

LOUISIANA *and* ARKANSAS *Offer Opportunities for Developing Many New Industries*

By William Crooks

President, The William Crooks Engineering Corporation, Little Rock, Ark.

LOUISIANA and Arkansas have large and diversified mineral deposits, but this territory is now, as it has always been in the past, predominantly an agricultural section. This condition was brought about largely by the manner in which the territory was settled, and the character of the early settlers. Louisiana was settled largely as a result of French immigration by a people who have unusually strong agricultural instincts. The alluvial bottom lands of Arkansas offered attractive possibilities to settlers interested in agriculture. The mountainous, and hill sections of Arkansas and the hill section of northern Louisiana were pre-empted by the pioneer stock which had settled originally in the mountains of Carolina, Georgia, Kentucky and Tennessee, and the descendants of these settlers form a large portion of the present population of Arkansas.

Lacking leadership and initiative, this same population has been the partial cause of the slow development of the resources of Arkansas. Paradoxically, it is equally true that this large population of native white, Anglo-Saxon strain is one of the greatest present assets of the state for it furnishes a plentiful and dependable supply of labor.

Louisiana and Arkansas may roughtly be divided into three areas with distinctive topographical characteristics. These are (1) the alluvial section of the coastal plain, (2) the hill section of the coastal plain and (3) the mountainous section of north and west Arkansas. The native white population that originally settled in the mountainous section of Arkansas has spread to the hill section of the coastal plain in Arkansas and Louisiana. In this section of Arkansas and Louisiana the total white population is 1,557,000, while the native white population is 1,540,000.

These native Americans make workers that are naturally intelligent, easily trained, and are capable of a high degree of efficiency. Morally they are of a higher type than the foreign element found in the industrial sections of the North and East, with social standards that are above the average. The industrial executives of plants locating in this section will find that this class of labor is loyal and appreciative of good treatment and personal pride is highly developed. They cannot be forced or driven as can the average European labor, but with kindly treatment and encouragement, they will be found to be continually exerting themselves to better their conditions, and improve their workmanship.

The principal mineral deposits of Louisiana of interest to the chemical engineering industries are made up of salt, lignite, oil, and natural gas. There are also restricted deposits of limestone, green marl, and volcanic ash. The minerals located in Arkansas that are in deposits sufficiently large to be worked commercially are: antimony; asphalt; bauxite; chalk; clays being found in the form of kaolin, ball clay, brick and tile clay; coal; diamonds; dolomite; fullers earth; galena; granite; glass sand; gypsum; pyrites; limestone; lignite; manganese; marble; novaculite; ochre; natural gas; petroleum; phosphate; pyrophyllite; quartz; serpentine; slate; soapstone; tripoli; talc; and zinc ores, both carbonate and sulphide.

The salt deposits of Louisiana are in the form of salt domes, and are located in the southern, central, and northwestern parts of the state. Forty-six domes are known to exist, and it is probable that others will ultimately be located. The salt in the domes at Avery's, Week's and Jefferson's Islands is mined commercially. These three mines produce approximately 500,000 tons of salt per year. The salt is practically pure sodium chloride. The thickness of the salt in the Louisiana salt domes is unknown. One test hole was sunk to a depth of 3,000 feet without passing out of the rock salt formation.

The lignite deposits of Louisiana, and southwest Arkansas, have not been mined commercially except in a small way some years ago near Camden, Arkansas. Deposits of lignite have been found at some 70 points in northwest Louisiana and southwest Arkansas, the deposits varying in thickness from a few inches to 20 feet. In analysis these lignites compare very closely to the best of the lignites in the Texas area, a fair average being 44.5 per cent volatile combustible matter, 32 per cent moisture, 17 per cent fixed carbon, 6 per cent ash, and 0.5 per cent sulphur.

Oil is found in many points in Louisiana, and in the

south central part of Arkansas. The various oil fields are indicated upon the map on page 689. In 1926 the crude oil production of Louisiana was 23,740,817 bbl., while for the same period the Arkansas production was 58,704,400 bbl., making a total of 82,445,217 bbl.

VARIOUS natural gas fields of Louisiana and Arkansas are also shown on the map. These may be roughly divided into the Shreveport area, the Monroe area, the Smackover area and the Fort Smith area. Of these four areas the Monroe area is the most important, it being one of the largest of the world's gas fields. This area includes the original Monroe gas fields and the new Richland gas field. The Monroe gas field has a proven area of approximately 400 square miles. The gas is found in porous lime rock, practically all of the wells being in the upper of the two gas-bearing rocks. The lower rock has only been penetrated by a few wells. The present average rock pressure for the 400 square miles is 850 lb., varying from 1,020 lb. in the northern portion to 300 lb. in a small area in the southern portion. The 300-lb. area contains what is known as wet gas, and has been drawn on very freely for the recovery of gasoline. The present estimated recoverable reserve in the top sands or rock of the Monroe gas field is 4,155,000,000 M.cu.ft. The new Richland gas field just southeast of Monroe has not been drilled sufficiently to determine its area, but indications are that it will closely approximate the original Monroe gas field in commercial importance.

The natural gas in the Shreveport area is found in a number of gas-bearing fields, varying in extent. The Shreveport area has been furnishing natural gas for domestic and commercial purposes in northwest Louisiana, southwest and central Arkansas for a number of years, and it is estimated that the present recoverable reserve is 1,500,000,000 M.cu.ft.

The Smackover gas areas are located adjacent to the Smackover oil fields. The proven area at Smackover is comparatively restricted, but since there are four gas-bearing sands it is estimated that the present recoverable reserve is approximately 1,000,000,000 M.cu.ft.

The Fort Smith gas areas are made up of several gas bearing fields which have been furnishing gas for domestic and industrial purposes at Fort Smith, and the immediate vicinity since the first discovery in 1904. The present recoverable reserve in the Fort Smith gas fields is probably 1,500,000,000 M.cu.ft. Thus the total reserves for all fields is quite imposing.

Since the discovery of the Monroe fields the gas has largely been used in the city of Monroe, for domestic purposes, and in the field for the recovery of carbon black. Pipe lines have recently been installed to convey the gas to Baton Rouge for use at the refinery of the Standard Oil Company. Pipe lines are now under construction into Arkansas to furnish industrial gas, and to increase the supply for domestic purposes. Utilization is also being made of the Monroe gas, as fuel in a large central steam generating station with 120,000 kw. capacity.

CARBON black plants in the Monroe fields have, in the past, produced approximately 75 per cent of the output of the United States. A plant for the recovery of carbon black from natural gas by means of an electric arc has been installed with the result of an increase in the amount of carbon black recovered per M.cu.ft., and the release of a large amount of hydrogen gas. This is now going to waste.

The analysis of the natural gas from the Monroe field is as follows:

Carbon dioxide	0.3 per cent
Oxygen	0.4 per cent
Methane	93.4 per cent
Ethane	1.0 per cent
Hydrogen	4.9 per cent

The fact that the gas is practically pure methane has lead to the theory that it will be possible to use it in the manufacture of synthetic methanol. A plant has recently been established for experimental purposes along these lines at Monroe.

Louisiana still has large pine forests and produces annually approximately $3,000,000 worth of turpentine and rosin. Louisiana's sugar-cane crop in normal years will approximate 3,700,000 tons of cane. This will produce some 200,000 tons of sugar, and leave a large residue, probably of an equal amount, of molasses known to the refiners as "black strap." This is used at New Orleans and various other points in the United States, and in foreign countries, for the manufacture of industrial alcohol.

Arkansas does not produce sugar cane, but is a large producer of corn and sweet potatoes, and it has been found that Jerusalem artichokes grow very satisfactorily with a large yield per acre. This supply of raw material closely adjacent to the Monroe gas field, where cheap fuel is available, as well as cheap power, together with transportation from Monroe to New Orleans, may make the establishment of alcohol plants in north Louisiana attractive.

For many years the world's largest source of sulphur was the sulphur deposit in southwest Louisiana. This particular deposit has been practically exhausted, and the sulphur producing activities have been transferred to similar deposits in south central Texas, near the Gulf coast. The territory immediately adjacent to the Gulf of Mexico in southwest Louisiana, and in Texas are very similar in their general characteristics. The fact that the sulphur had been found at these points along the Gulf coast would indicate that there are perhaps similar sulphur deposits in southern Louisiana. This theory is borne out by the fact that sulphur has been found in numbers of wells in central and southern Louisiana; some deposits of marl in central Louisiana contain as much as 6 per cent sulphur.

Arkansas contains deposits of pyrites, but the probable future supply of sulphur for sulphuric-acid plants in Arkansas, and in northern Louisiana will come from the roasting of the zinc sulphide ores of the White River basin. When the proposed hydro-electric units are installed in the upper White River in northern Arkansas, cheap power will be available for mining operations, and probably for the transportation of the ores over electrified tram-roads from the mines to railroad shipping points. The reduction in cost of producing the ore f.o.b. railroad cars by this means will offset the extra transportation cost between the shipping point and the natural gas at Monroe.

The utilization of the salt deposits of Louisiana will probably play an important part in the future production of chlorine and caustic soda. The combination of cheap natural gas as fuel, and an ample supply of condensing water has made it possible for the Louisiana Power Company to install a large central generating station with production costs that are much below the average steam plant, and cheaper than at many hydro-electric installations. It may not be possible to mine the salt in south-

ern Louisiana and transport it to northern Louisiana by rail at a cost sufficiently low, but it will be possible to sink wells at some of the domes fairly closely adjacent to Monroe, and make use of transmission lines in supplying the necessary current. This indicates the possibility of reducing the cost of production of caustic soda and chlorine to a level approaching that at Niagara Falls.

THE growing demand for salt cake by the Louisiana and Arkansas paper mills that manufacture kraft paper from pine wood, will materially aid in solving the problem of producing cheaper salt cake at points closely adjacent to paper production. Experiments are being carried on to determine the possibility of bleaching kraft paper, and the successful solution of this problem will give a greatly increased demand for chlorine in the paper mill section.

The kraft paper manufacturing industry is being rapidly developed in Louisiana and in Arkansas; mills are being operated at Bogalusa, Elizabeth, West Monroe and Bastrop in Louisiana, and a mill is under construction at Camden, Arkansas. The combined capacity of these mills is 700 tons per day. This does not include the paper mill at Orange, Texas, which is located almost on the boundary between Louisiana and Texas. The combined yearly requirements of the Louisiana and Arkansas paper mills is 1,250 cars of salt cake, 1,500 cars of lime, 500 cars of alum, and 75 cars of soda ash.

Due to the cheaper stumpage and labor, year around logging operations, and rapidity of growth of the Arkansas and Louisiana pine, the paper mills in this territory are now producing kraft paper at a cost approximately 20 per cent less than the northern mills. There is an ample supply of short leaf pine in Arkansas and southern Louisiana to provide raw materials for at least four times the present installed paper-making capacity. In view of these facts it is very probable that in a short time a great majority of the kraft-paper plants will be in the south, more especially in the Louisiana and Arkansas soft pine sections.

Up to the present time it has not been found commercially practical to manufacture news print, and book paper, from the southern pines, although some encouraging experiments have been carried on. It is economically wrong for the northern mills to continue to manufacture kraft paper from northern woods that are adapted to the manufacture of news print and book paper, when the kraft paper can be manufactured in the South cheaper and of a better grade. The removal of the kraft paper mills to the South would release a large amount of spruce, and other woods to the manufacture of higher-grade papers, and would have a tendency to check the prospective scarcity of northern pulp.

The limestone areas of north Arkansas are very extensive, and with the exception of the isolated deposits of limestone at Winnfield, Louisiana, this is the first limestone that is found north of the Gulf of Mexico. It has been used extensively for the manufacture of lime, and certain of the deposits make an excellent chemical lime which is used extensively by the paper mills of north Louisiana, in preference to any other lime.

Louisiana is now one of the largest fur producing areas in the world. The 1925 take was 6,731,000 pelts; in comparison with this during the same period all provinces of the Dominion of Canada had a take of but 3,820,000 pelts of all kinds. Consideration is being given to the possibility of tanning, curing, and finishing for market the pelts locally, especially if the Bureau of Standards research in connection with the use of waste liquors from paper mills for tanning hides is put into successful commercial use.

The Arkansas coal fields are made up of the bituminous, and semi-anthracite deposits located in the west Arkansas River valley, the bituminous coal fields being an extension of the Oklahoma deposits. Coal is being mined in Arkansas at the rate of approximately 1,400,000 tons per year. It is estimated that the reserve, assuming an 80 per cent recovery, is 850,000,000 tons.

BAUXITE deposits of Arkansas are located along the base of the granite ridge which extends westward from Little Rock. The largest of these deposits is at the town of Bauxite about 20 miles west of Little Rock. The deposit at Bauxite is owned and operated by the Aluminum Company of America. The output of Arkansas bauxite has run fairly constant since 1916, averaging about 1,900,000 tons per year, this being approximately 94 per cent of the bauxite ore produced in the United States.

Pike County, Arkansas, is the only locality in North America where diamonds are found in the rocks in which they are formed. At this point the diamonds occur in dikes of volcanic rock known as peridotite, which closely resembles the material in which diamonds are found in Africa. There are four separate areas of this peridotite which aggregate about 80 acres. Some 3,000 carats have been recovered, the largest of the stones weighing 20¼ carats.

Also in Pike County, and in the adjoining country, there are seven deposits of asphalt. One of these deposits was worked commercially, but all recovery work has been abandoned temporarily due to the large supply of cheap petroleum asphalt derived from the crude oil residues.

Manganese is found in several localities in Arkansas. The most important area is known as the Batesville area, and covers about 100 square miles. It was estimated by the United States Geological Survey that the Batesville area held 250,000 tons of ore containing 40 per cent or more of manganese, and 170,000 tons containing less than 40 per cent. The production of manganese in Arkansas is approximately 3,600 tons per year, although in 1917 more than 10,000 tons were produced. The production of manganese, and this applies to a great many of the mineral deposits in Arkansas, has been in the past badly handicapped by transportation facilities, and the lack of power. Both of these handicaps are being somewhat removed by the construction of improved highways, and the installation of hydro-electric units and transmission lines.

The clays of Arkansas are widely distributed, and are found in great abundance and variety. They vary from the low grade buckshot material, which can be used for brick making, to the high-grade kaolin deposits of central Arkansas. In what is known as the Ouachita River area excellent grades of ball clay are found. The present yearly consumption of clays for pottery and brick making purposes in Arkansas is 152,000 cubic yards.

Arkansas contains deposits of the various forms of silica such as glass sand, fullers earth, pyrophyllite, tripoli, talc, soapstone, and volcanic ash. Many of these deposits are free from iron oxide, and analyze as high as 98.5 per cent of SiO_2. The glass sand deposit at Guion, in the upper White River basin, is highly regarded

by glassmakers, and shipments average approximately 45,000 cubic yards per year.

Originally the whole state of Arkansas except about 900 square miles of prairie land was covered with a forest growth. It is now estimated that 60 per cent of this area, or 20,000,000 acres, is still woodland or forest grading from heavy timber to brush area. About 100 species of trees grow in Arkansas, but only about 60 are used commercially. Of these 13 are of primary importance, although the total cut of the remaining 47 is large.

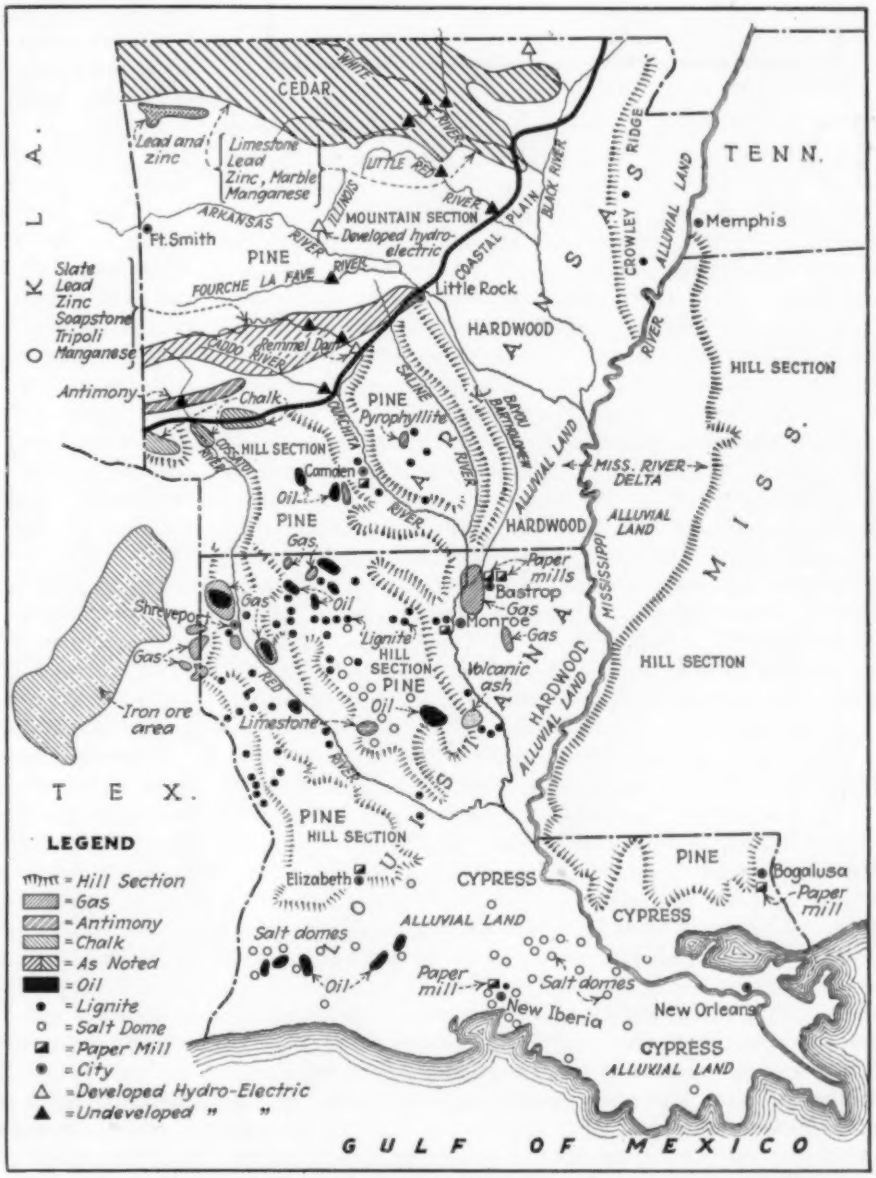
Louisiana ranks third among the states in the production of lumber, and it is estimated that the present area of virgin forests is 2,500,000 acres. The earlier cut-over lands in the soft pine area are again coming into production. The principal lumber production of Louisiana is pine, followed in importance by cypress. There are still large uncut areas of hardwood of the species of oak, hickory, pecan, black walnut, magnolia, gum tupelo, cottonwood, poplar, elm, ash and persimmon.

CENTRAL and northern Louisiana, and the state of Arkansas, are fortunately located in regard to power possibilities. Northern Louisiana has the oil fields and the natural gas fields of Shreveport and Monroe as sources of fuel supply, while central and northern Arkansas has many hydro-electric possibilities both developed and undeveloped. Western Arkansas has the Fort Smith gas fields and the coal areas as a fuel supply. The hydro-electric units of Arkansas have been interconnected with the steam generating station at Sterlington, in the Monroe gas field, bringing about the guarantee of continuity of service, and efficient operation. The undeveloped hydro-electric possibilities of Arkansas are estimated to amount to 200,000 hp. of primary power and approximately the same amount of secondary power. The largest of these undeveloped projects is in the White River in the northern portion of the state.

The map accompanying this article shows in the northeast Texas iron ore beds, and is included for the reason that the ultimate utilization of the east Texas iron ore deposits will undoubtedly come through the use of the natural gas in the Monroe field. The total iron ore bearing area of the northeast Texas fields is between 1,250 and 1,400 square miles. The iron is limonite with small deposits of siderite. The ore exists in blankets near the tops of the hills and ridges, and generally has less than five feet of overburden. The deposits vary from two to five feet in thickness. At some points two and three strata are found, separated by a thin bed of sand, clay, or thin sandstone. Some of the deposits that have been worked were found to carry 55 per cent to 57 per cent of iron ore. It is probable, however, that the average iron content for all of these deposits is between 40 per cent and 45 per cent.

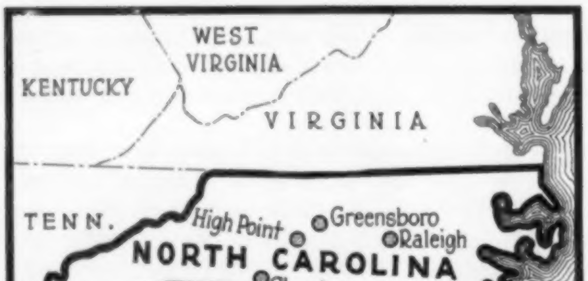
Antimony occurs in a rather narrow belt in the western part of Arkansas. The ore is associated with small amounts of copper, iron, zinc, and bismuth sulphides. The antimony mines have been operated spasmodically during periods of high market value for this metal and its salts.

In the past Louisiana and Arkansas have been backward in the development of their chemical and metallurgical resources. The business men of these states, however, are generally beginning to realize the importance of these, and are building the ground work necessary for a more complete utilization of the mineral resources. This work is largely in the nature of providing a secondary transportation by means of improved highways; the developing of the power situation, both as to generating units and transmission lines; and an intensive study of the possibilities of chemical engineering development. The two states have for many years been adequately supplied with railroad transportation, and are reaching the condition where all of the primary factors affecting industrial growth along chemical engineering lines are favorable.



Natural Resources of Louisiana and Arkansas of Interest to Chemical Engineering Industries

Diversified Chemical Industries Are Needed in the CAROLINAS



By Peter S. Gilchrist

President, Chemical Construction Company, Charlotte, N. C.

DESPITE the fact that North and South Carolina have made striking industrial progress during the past ten years, the people of these two states are just now beginning to appreciate how much remains to be done. Future possibilities for active, diversified industry appear almost unlimited. A great need exists, particularly for those chemical engineering industries that can take full advantage of abundant hydro-electric power, plentiful labor, excellent transportation and climatic conditions, and—most important—a rich market in existing chemical consuming industries.

Each year the chemical industries in other parts of the United States send into the Carolinas approximately $40,000,000 worth of chemicals which are used mostly in the manufacture of textiles, fertilizers, leather, rubber and food products. The bleaching, finishing and processing of textile fabrics accounts for an estimated annual consumption of chemicals and dyestuffs valued at $31,500,000. According to these estimates, made by the editors of this magazine, approximately $19,000,000 worth are used in North Carolina and $12,500,000 worth in South Carolina. The farmers of the two states used in 1926 approximately $56,000,000 worth of commercial fertilizer, most of which was manufactured or blended in the Carolinas. Existing chemical industries in this district annually consume at least $1,250,000 worth of chemical products.

LOCATED in the Carolinas are more than 7,000 manufacturing establishments of all kinds with an annual output valuation of $1,450,000,000. These enterprises use approximately $950,000,000 worth of raw materials and pay annually to their employees around $250,000,000. The Piedmont section of the Carolinas leads all the states in the union in the number of textile mills and in the manufacture of tobacco products. It has the largest towel factory, the largest damask mills, the largest underwear plants, the largest hosiery mills, the largest denim mills and the second largest aluminum plant in the world. Many of these are consumers of chemicals.

Textiles. With over 11,000,000 active spindles in the Carolinas, cotton yarns in the greatest abundance are available to weavers, knitters and mercerizers. These require chemicals of all kinds, consisting principally of dyestuffs, mineral and organic acids, chlorine, caustic soda, soda ash, sulphonated oils, aqua ammonia, alkalis, oils, soap, washing soda, starches, etc.

Fertilizers. Approximately 105 plants manufacturing and blending fertilizers, many of which manufacture their own acid phosphate and sulphuric acid, enabled the Carolinas to supply a large share of the $56,000,000 worth of the fertilizer used in the two states in 1926. Phosphate rock from Florida, sulphur from Texas, nitrogen and potash from other localities, enable the plants on the Atlantic Coast to obtain their raw materials at a very low rate and ship inland to the ever increasing agricultural centers.

Ceramics. From the 95 ceramic plants in the Carolinas are obtained such building materials as face brick, common brick, hollow building tile and sewer pipe amounting in value to over $7,500,000 per year. Nevertheless it has been estimated that approximately $45,000,000 worth of high-grade ceramic materials are imported into the South each year—consisting principally of china ware, wall and floor tile, electrical porcelain and sanitary ware. It is interesting to observe that plenty of high-grade shale and clays, kaolin and feldspar are available locally for the manufacture of these imported wares.

Furniture and Wood Products. In addition to the famous forests of long leaf yellow pine, slash and short leaf pine, the Carolinas produce large quantities of such hardwoods as white oak, yellow poplar, red gum, cypress, black gum and various species of black and red oak. The annual timber cut is over two billion board feet. Drawing on this large stand of hardwood is one of the country's most important furniture industries, having an annual output valued at well over $60,000,000. Such cities as High Point, Thomasville and Winston-Salem are the established centers of the southern furniture industry that today produces almost a third of all the furniture made in the United States.

Chemical engineering interest lies principally in the fact that these furniture factories consume large quantities of varnish, lacquer, stains and finishes as well as

silicate of soda and various adhesives. Furthermore there appear to be opportunities for utilizing the hardwood wastes from these factories for the production of wood distillation products. Such byproduct industries flourish elsewhere in the United States.

A related, although somewhat smaller industry is engaged in the production of tanning extracts from Carolina woods. Five North Carolina plants in 1923 produced $1,463,291 worth of tanning materials and natural dyestuffs.

Rubber. There are three rubber manufacturers in the Carolinas producing automobile and truck tires valued at $3,500,000 per year. Only the fabrics are produced locally. The crude rubber, carbon black, zinc oxide, sulphur and miscellaneous rubber chemicals are imported into the district.

Minerals. The remark has been attributed to Thomas A. Edison that "North Carolina is Nature's sample room" in so far as mineral deposits are concerned. Certainly the list of useful minerals cataloged by the N. C. Department of Conservation and Development is most imposing—containing over 1,100 entries. The total value of mineral production in a recent year was $13,012,000. Feldspar is one of the most valuable Carolina minerals, although kaolin, graphite, mica, quartz, talc and soapstone, granite and limestone are all important.

The North Carolina feldspar industry has grown from a production in 1916 of 31,000 tons to 97,000 tons in 1924. The 1926 output of about 85,000 tons represented 38 per cent of the total production of the United States. This output was from 35 mills serving the mines located in the Spruce Pine district in Mitchell, Yancey and Avery counties.

Coal. The Carolinas are conveniently located in relation to the coal fields of Tennessee and West Virginia. While no coal of appreciable amount is found in that part of the two states bordering on these coal sections, it is interesting to note that in the center of North Carolina two coal mines are in operation producing approximately 80,000 tons annually. The Carolina Coal Company at Cumnock, N. C., produces a coal of 13,900 B.t.u. capable of giving a gas yield of about 11,000 cu.ft. per ton. Deep River flows within a half mile of this mine. A chemical plant located near this mine would therefore find unusual shipping facilities and would be strategically located to serve the Carolina market.

A Million Horsepower Available

The rate of increase in the output of electrical energy is always a reliable index of industrial development and activity. It is significant therefore that the average annual rate of increase in power output in the State of North Carolina since 1920 has been 16.4 per cent. These rates of increase over each preceding year have been as follows: 1920, 12.3 per cent; 1921, —3.8 per cent; 1922, 30.1 per cent; 1923, 43.3 per cent; 1924, 7.9 per cent and 1925, 4.5 per cent.

The combined capacity of the hydro-electric and steam plants of North Carolina is approximately a million horsepower. The status of power development in this state, as given by the N. C. Department of Conservation and Development in Circular No. 16 "The Power Situation in North Carolina," will be observed from the following tables. (It should be noted that these figures refer to the situation in 1925 and that developments since that time have increased the total by at least 10 per cent.)

Table I—Water Power Development in North Carolina

Company	Plant	Development on the Stream Used	Installed Horsepower	Total Horsepower
Southern Power Co....	Bridgewater.....	Catawba.....	33,500	
	Lookout Shoals..	Catawba.....	31,000	
	Mountain Island	Catawba.....	80,000	
	Rhodhiss.......	Catawba.....	45,000	189,500
Carolina Power and Light Co...........	Blewett Falls....	Yadkin......	32,150	
	Buckhorn Falls..	Cape Fear....	3,900	
	Carbonton......	Deep.........	1,350	
	Lockville.......	Deep.........	1,350	
	Marshall........	French......	4,000	
	Weaver.........	French......	3,350	
	Other plants.....	....	3,000	
	Norwood*......	Yadkin......	83,000	49,100
Tallassee Power Co....	Narrows........	Yadkin......	128,000	
	Yadkin Falls....	Yadkin......	28,980	
	High Rock*.....	Yadkin......	44,100	
	Cheoah.........	Little Tenn...	96,000	252,980
Blue Ridge Power Co...	Tuxedo.........	Green.......	8,000	
	Turner.........	Green.......	8,400	
	Big Hungry.....	....	400	16,800
Virginia Electric Power Co.................	Roanoke Rapids	Roanoke.....	8,710	8,710
Other Public Util. Co's.	....	....	....	25,000
Manufacturing plants, census 1919.........	....	....	....	44,700
Manufacturing developments and miscellaneous plants since 1919	....	....	....	10,210
Total developed horsepower.....	....	....	....	597,000

*Under construction, and not included in totals.

Table II—Steam Power Developed in North Carolina

Company	Plant	Source of Condensing Water	Installed Horsepower	Total Horsepower
Southern Power Co....	Eno............	Eno.........	34,000	
	Mount Holly....	Catawba.....	50,000	
	Greensboro......	....	10,000	
Carolina Power and Light Co...........	Buck*..........	Yadkin......	100,000	94,000
	Raleign.........	....	4,350	
	Goldsboro.......	....	1,350	
	Cape Fear......	Cape Fear...	40,000	
	Elk Mountain...	French Broad	17,500	
Virginia Electric and Power Co...........	Cumnock.......	Deep........	1,800	65,000
	Roanoke Rapids	Roanoke.....	2,680	4,730
	Tarboro........	Tar.........	2,050	4,730
Tidewater Power Co...	Wilmington.....	....	15,000	15,000
Other Public Util. Co's.	....	....	40,000	40,000
Manufacturing plants, census 1923.........	....	....	....	251,420
Total............	....	....	....	470,150

*Under construction and not included in totals.

Interconnection of the important transmission lines of the Carolinas into one great flexible system has been an important power development. Last year, according to John Paul Lucas, director of the industrial department for the Southern Power Company, 1,433,759,975 kw.-hr. of energy were transmitted over more than 3,000 miles of transmission lines to 160 different industrial communities in the Carolinas as well as to many isolated mills and factories.

Prospects for Future Chemical Industries

Summing up, therefore, it would appear that the prospective chemical manufacturer will find available in the Carolinas: (1) An abundance of electric power economically generated by modern hydro-electric or steam developments. (2) Intelligent and loyal labor of native-born American stock. (3) Ample transportation facilities either by railroad or over concrete highways. (4) A wide variety of raw materials for chemical industry e.g. cottonseed for oils, soaps or shortening compounds; cotton linters for nitro-cellulose lacquers, plastics and rayon; clays, feldspar, cyanite and shales for ceramic products; hardwood waste for the manufacture of wood distillation products; and numerous other rich mineral and agricultural products basic to industry. (5) An active consuming market for chemicals of rapidly increasing importance.

An unusual combination of favorable manufacturing conditions awaits the progressive chemical industries that locate in this region.

Chemical Engineer's Bookshelf

X-Rays, Past and Present

X-Rays, Past and Present. By *V. E. Pullin* and *W. J. Wiltshire*, of the Research Department, Woolwich Arsenal, Woolwich, London. D. Van Nostrand Co., New York. Price $4.50.

Reviewed by A. W. Allen

Science, according to the authors of this excellent monograph, is to a certain extent capable of accurate interpretation in non-technical language. As a result, the interested and inquiring layman, as well as the scientist in other branches of research, can now turn to an authoritative and interesting account of the history, development and application of X-rays. More books of this kind are urgently needed, written by specialists with the necessary knowledge at their finger tips—specialists who are willing to put themselves in the position of the busy but cultured layman, who dislikes to have his intelligence insulted by the various alternatives to accuracy and clarity that masquerade as "popular science."

Science must look to industry for financial and moral encouragement, and more fruitful results will be obtained when scientists become articulate to their fellow beings. To date the problem has been attacked too much from the scientific viewpoint. As the authors remark: "The most powerful factor operating against innovation is the old and indisputable fact that 'my father did perfectly well without it.' This idea, even when not expressed in words, is a convenient mental armchair in which to indulge the inherent laziness that characterizes the solid British business man." This indictment is all too true. Here in the United States the innovation gets a better welcome; but the scientist or the inventor seldom reaps an adequate reward.

Radiological research began early in the eighteenth century, we learn, and advanced slowly but surely to the invention of the Crookes tube in 1879. Stimulation of thought and the rapid development of apparatus were largely the result of conflicting views on theory. In 1895 Röntgen discovered X-rays—a logical outcome of a scientific study of the vacuum tube. The account demonstrates that nothing is more fascinating than historical truth, especially in the outward and visible results of mental evolution and human inquisitiveness.

Subsequent chapters discuss "The Nature of Visible Light," "Weighing the Electron," "X-Rays and the Atom," "X-Rays and Crystals." The chapters on the application of X-ray spectroscopy will prove of especial interest to the engineer and the technician. In metallurgy, X-ray analysis is of immense actual and potential value. The effect of strain may be determined without destruction. Enemy bombs during the War could be analyzed without dissection or hazard. In welding work, an X-ray examination will show at once the strength of the joint. An expenditure of $2.50 on the preliminary X-ray of a casting may prevent the waste of $300 or so on useless machining. Glued wood joints are best inspected by means of X-rays, and the fit of screw threads can be determined by the same means. Other uses include methods for the detection of impurities in foodstuffs, for the discovery of pearls in oysters, to distinguish between real and artificial gems, to discover the contents of parcel-post packages and to determine the character of the insulation on electric cables. In the authors' opinion, the fact that chemical analysis by X-rays has not been brought to perfection is not due to any inherent defect in the method, but is due rather to the simplicity and accuracy of prevailing methods of technical analysis. Industrial progress may demand the wider utilization of the newer discoveries dealt with in the book under review. When such a need arises, it is averred, a technique will be developed permitting a high degree of accuracy.

* * * *

Dyes and Dyeing

Dyestuffs and Coal Tar Products. Manuals of Chemical Technology—1. Edited by *Geoffrey Martin*. D. Van Nostrand Company, New York. 168 pages. Price, $5.

Reviewed by H. T. Herrick

This volume, like a number of others of a similar type, is an attempt to include a prodigious amount of material in a limited amount of space. Published in its first edition in Great Britain in 1915, when the need for information of this nature in the form in which it was presented may have been very great, it is now brought out as a fourth edition, embellished by additional data on intermediates, catalytic reactions, and other developments in the field of organic chemistry.

The reason for this decision is not entirely clear. It would seem that a series of volumes covering the same field of knowledge in a more comprehensive way would serve a wider demand, provided always that sufficient authentic data could be obtained, and that publishers would feel themselves justified in such an undertaking. In other words, it would be better to strive for everything about something, rather than something about everything.

Granting the limitations of the encyclopædic method of disseminating scientific information, the author has done a fairly good job. It is true that various important compounds are missing from his outline, but importance in such cases is a matter of individual opinion, depending on the experience of the critic. Each chapter is preceded by a list of reference volumes, some of which are old and some more recent, to which the reader may turn for the detailed information mentioned above. The book may be of interest to those desiring condensed information, but there is little in it that is startling or original.

* * * *

Dyeing With Coal-Tar Dyestuffs. By *C. M. Whittaker*, Second Edition. D. Van Nostrand Co., New York. 248 pages. Price, $3.50.

Reviewed by Wm. D. Appel

The second edition of this eminently practical little book which deals with the principles involved and the methods employed in the application of the coal-tar dyestuffs follows closely the arrangement and phraseology of the first edition. The chapter on vegetable

and mineral dyestuffs has been discarded and a chapter on "The dyeing of artificial silk (Rayon)" introduced. The text has been modified to include reference to solublized vat dyestuffs, the extension of the range of insoluble azo pigments ("azoic dyestuffs"), and the use of the katanols as substitutes for tannic acid in the mordanting of vegetable fizers. The chapter on "Other uses of coal tar dyestuffs" is so sketchy as to be of little value and the references contained in it do not always include the best.

In view of the criticism of the previous edition of this book (cf. J. Soc. Chem. Ind. 40, 97R [1921]) and of the author's book "Testing Dyestuffs in the Laboratory" (ibid, 38, 35R [1919]) with respect to English and phraseology, it appears inexcusable that no improvement is to be noted in the present volume. This is not a criticism of the use of mill terms for the operations described, although a glossary of the meaning of terms liable to be obscure to the novice would no doubt extend the usefulness of the book.

The book can be recommended to anyone seeking practical information about the application of coal-tar dyestuffs to textile fibers.

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Rubber Technology

Gottlob's Technology of Rubber. English Translation of 1925 Edition by *J. L. Rosenbaum.* Maclaren & Sons, London. 336 pages. 117 illustrations.

Reviewed by O. R. Neitzke

THIS book should be of value to anyone interested in entering the field of rubber technology, or to the practical rubber man who wishes to become acquainted with the theoretical background of the industry. A large portion of it is devoted to theory, fairly bristling with 600 references to the researches of 300 authors. The book, which is divided into two parts with an introduction of 27 pages on the chemistry of the raw natural hydrocarbon, devotes excessive space to the ozonides.

Part I on general technology includes chapters on the preparation and properties of raw rubber and latex, mixing, calendering, fillers, accelerators, vulcanization, ageing, chemical analysis and mechanical testing. The chapter dealing with latex confines the relatively well known work of Hauser to a footnote, although the investigations of other workers on the latex particle is discussed. The section on filling materials includes a good discussion of the mechanical effects of reinforcing materials such as carbon black, from the point of view of particle size and specific surface. The chemistry of vulcanization is well treated at some length. Synthetic rubber is briefly discussed, being dismissed as "no longer a practicable proposition." No mention is made of antioxidants, which have been in use in this country for some years.

Part II on special technology includes chapters on mechanical rubber goods, heels, toys, rubber-proofed cloth, tires, shoes, ebonite goods and cold vulcanized goods. It consists of descriptive matter with a large number of illustrations of the various types of machinery. The importance of pneumatic tires is not evident from the hopelessly out-of-date description of fabric tire manufacture, with bare mention of cord tires and no mention of balloons. In general part II does not come up to the standard of part 1 and can by no means be considered up-to-date.

Statistical Mechanics with Applications to Physics and Chemistry. By *Richard C. Tolman,* professor of physical chemistry and mathematical physics, California Institute of Technology. The Chemical Catalog Company, Inc., New York. 334 pp. Price $7.

This book presents the theory of statistical mechanics with particular reference to applications in physics and chemistry. The elements of classical and quantum mechanics have been included in sufficient measure to serve as a foundation for statistical mechanics.

* * * *

An Introduction to Organic Chemistry. By *Roger J. Williams,* associate professor of chemistry, University of Oregon. D. Van Nostrand Company, Inc., New York. 565 pp. Price $3.50.

The author's reason for adding to the already large number of textbooks of organic chemistry is to rationalize the subject further. An attempt has been made to relate this branch of the science with inorganic and physical chemistry, through the Lewis theory of valence and atomic and molecular structures, together with the author's original concepts.

* * * *

Organic Chemistry. International Chemical Series. By *Frank E. Rice,* professor of Chemistry, North Carolina State College. McGraw-Hill Book Company, Inc., New York. 303 pp. Price $2.50.

This text is designed particularly for students in applied biological fields, as agriculture, home economics, medicine, dental science, pharmacy and veterinary science. The book will not be difficult reading to those without extensive preliminary training in chemistry, and consequently it should have an appeal to engineers who have lost contact with the more recent developments based on organic chemistry.

* * * *

A Text-Book of Organic Chemistry. By *Julius Schmidt,* professor of chemistry in the Technische Hochschule, Stuttgart. English Edition, by *H. Gordon Rule,* lecturer in organic chemistry, University of Edinburgh. D. Van Nostrand Company, New York. 798 pp. Price $9.00.

In this preface, the translator says: "Schmidt's 'Kurzes Lehrbuch der Organischen Chemie' requires no introduction to students of chemistry. In it the author has produced something more than an encyclopædic collection of chemical facts, he has succeeded in writing a book which stimulates the reader to think for himself.

* * * *

The Engineering Index—1926. Published by the American Society of Mechanical Engineers, New York. 809 pp. Price $7.

The 1926 Index lives up to the standard set by the preceding volumes of the series. The number of references has been increased, as has the number of periodicals reviewed. The usefulness of this work is unquestioned. It merits the unstinted support of all engineers.

* * * *

Technical Methods of Analysis As Employed in the Laboratories of Arthur D. Little, Inc., Cambridge, Mass. Edited by *Roger Castle Griffin,* director of analytical department. McGraw-Hill Book Company, Inc., New York. 936 pp. Price $7.50.

The second edition of this well-known and useful book is now available. More than forty additional methods have been included and the material of the First Edition has been revised when necessary. The principal changes in the plan of the book are the inclusion of a chapter on Water, Sewage and Soils, and material enlargement of the chapter on Foods.

Readers' Views and Comments

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Data Questionnaires for Equipment Maker and User

To the Editor of Chem. & Met.

Sir—I should like to present to readers of *Chem. & Met.* a plan of "Data Questionnaires" for use in preparing the technical catalogs compiled by manufacturers of chemical engineering equipment. This plan is presented from the viewpoint of one familiar with the "question sheets" and "questionnaires" at present used, but which do not supply the manufacturer with sufficient detailed information to help the actual purchaser of the equipment.

A salesman does not always approach his prospect with the purpose of an immediate sale of his product. He must get his prospect into the buying "frame of mind," usually by selling his service to him. In this process the salesman has made his prospect *think for himself,* to think the salesman's thoughts in terms of his own peculiar needs.

This latter purpose—to make the prospect think of his own needs—is the fundamental purpose of the "Data Questionnaire." Its further aim is to bring the manufacturer and prospective buyer into a better understanding of the details of the buyer's particular problems. By means of a series of questions, orderly and logical, this questionnaire secures more information for the manufacturer than the ordinary salesman could hope to obtain. The "Data Questionnaire" below is self-explanatory of this orderly and logical series of questions.

The ordinary salesman is not an engineer. It is the exceptional salesman who can ask and answer questions that ultimately bring to the prospect the machine that exactly meets his requirements. The data questionnaire should in some cases eliminate a salesman's call and at the same time open a greater field of live sales prospects. It brings to the manufacturer valuable information for use in sales promotion or for his files, greatly assisting him in his service to the field.

This, in effect, is a plan which I feel will greatly benefit both the maker and user of chemical engineering equipment.

D. S. Chamberlin,
Professor of Chemical Engineering.
Lehigh University,
Bethlehem, Penna.

The questions presented below are typical of those asked in a data questionnaire for a catalog on rotary driers.

Data Questionnaire for Rotary Driers

1. Description of material
   a. Technical or trade name....................................
   b. Chemical formula or approximate composition..........
   c. Lump......., Powder......., Paste......., Sludge......
   Fibrous.........., Friable.........., Gummy..........
   d. Size of particle, screen test..................................
   e. Weight per cu.ft..........
   f. If a sludge, what is its viscosity (at a specific temperature)
   g. Is the finished material dense, porous, combustible, volatile
2. Capacity per hour in dry tons of 2,000 pounds..............
3. Hours per day the drier is to be operated..................
4. The moisture content of the final product..................
5. Screen test of final product....................................
6. Weight per cu.ft. of the final product.......................
7. The temperature in deg. F. that the material will stand without injury, a. when dry.........., b. when wet..........
8. Should the material be dried by indirect means or by direct contact with furnace gases..................................
9. Will the material discolor; if so, is this permissible..........
10. What fuel will be used..
11. If steam is used, will it be dry or exhaust.....................
    a. Pressure of steam.........., b. quantity of steam.........
12. If coal, powdered coal, coke, oil or gas.........., a. heating value................, b. if directly heated will the ash or impurities affect the final product............................
13. What space is available for this installation..................
14. Is the space well enclosed.......................................
15. Sketch on the back of this sheet a plan showing the space available as well as the location of machinery for this proposed installation.
16. A small sample of the material, at least one pound, should be sent to us in a tight container. This will enable us to give more definite advice as to a proposed method of treatment.

Company Name ....

Information Furnished by..............................

Date........................ *Title*..........................

* * * *

Where "Old Soldier" was Wrong

To the Editor of Chem. & Met.:

Sir—"Old Soldier," whose letter appeared in one of your recent issues, had some amusing things to say about modern warfare but I wish to answer only one of his remarks, to wit, "Yours for more and better wars!"

What was the matter with the last war, I'd like to know? How could a war be better? Millions of men were killed and maimed. Widows and orphans were created daily by thousands. Town and country were devastated. More money was expended than ever before. Wages went up until laborers wore silk shirts at work. Those of us who were patriotic enough to be drafted learned many things which we had not known before. With a former T.N.T. plant superintendent, I helped to dig a latrine large enough to serve a regiment for ten years. He may have found that experience useful; I know I have. Many of us also discovered hidden talents.

We forced Germany to pay the entire expense of the war and enough besides to pay a bonus to all American service men. The debts owed us by the other nations were paid Nov. 12, 1918 (with the usual 2 per cent for cash). This money was turned over to the Chemical Warfare Service for research in making war absolutely painless.

The world was made absolutely safe for democracy. Now, we can do as we darn please (except believe in evolution). Indeed, the war gained lasting peace for the world, for not a rumor of war has been heard since, due to the fear of the wrath of the great League of Nations.

In the ways in which a war can be said to be "good," she was a good old war.

John M. Sanford,
Consulting Chemist.
Terre Haute, Indiana.

Selections from Recent Literature

Corrosion Inhibitors. U. R. Evans. *Journal of the Society of Chemical Industry,* Aug. 26, pp. 347-55T. Factors involved in the use of inhibitors have been studied. Much can be done by this means to prevent corrosion, but inhibitors must be used with caution; in certain cases they may be ineffective, or may even become accelerators of corrosion. Cases of localized corrosion, in particular, are likely not to be susceptible to the inhibitor treatment.

Artificial Musk. Alfred Wagner. *Chemiker-Zeitung,* Aug. 17, pp. 625-8; Aug. 24, pp. 646-7. The chemical nature of natural musk is discussed, and the commercial manufacture of xylene musk is described, with drawings of plant equipment. Manufacture of ketone musk is also briefly described. Uses, adulteration and testing are discussed.

Transformer Oil. Typke. *Chemiker-Zeitung,* Aug. 17, pp. 628-30. Methods of refining oil for use in transformers are described. The chief reagents are sulphuric acid, caustic and fullers earth. Properties of the refined oil, and specifications which it must meet, are discussed.

Mordants. P. P. Viktoroff. *Zeitschrift für angewandte Chemie,* Aug. 11, pp. 922-5. As a mordant for basic dyes, synthetic digallic acid is fully equal to natural tannins. Contrary to the conclusions of others, natural tannins break down in the dye bath, and digallic acid is the true active agent in forming the antimony-tannin compound which gives the mordanting effect.

Chemical Lime. Arthur Grounds. *Industrial Chemist,* Aug., pp. 349-52. Production of lime for chemical manufacturing processes is described. Photographs are shown of kilns (vertical and rotary) and of Dwight-Lloyd sintering machines.

Leather Manufacture. H. T. S. Britton. *Industrial Chemist,* Aug., pp. 362-6. An epitome of the stages in leather manufacture is given, as an introduction to a discussion of the influence of pH in the early stages. These include swelling, plumping, bating, puering and pickling. Electrometric titrations, significant in the tannery, are described.

Inorganic Chemicals. Hermann von Keler. *Zeitschrift für angewandte Chemie,* Aug. 11, pp. 911-21. A review, with 153 literature and patent references, of advances in the industry during the year 1926.

Coking Coal. F. S. Sinnatt, A. McCulloch and H. E. Newall. *Journal of the Society of Chemical Industry,* Aug. 12, pp. 331-5T. Cenospheres, a secondary structure, offer opportunities for intimate study of the structure and properties of coke. This study is confined to two major factors in carbonization: atmosphere, and mixture of caking with non-caking coal. Cenosphere formation is inhibited by evacuation and by steam, but not by nitrogen, coal gas nor hydrogen. Electrode carbon, mixed with coal, reduces cenosphere size.

Reducing Vat Dyes. F. Bryans and F. M. Rowe. *Journal of the Society of Chemical Industry,* Aug. 12, pp. 335-8T. The proposition of electrolytic reduction is very attractive from cost considerations; but most vat dyes resist reduction by electrolytic hydrogen. The process is applicable in selected cases, sometimes with the aid of such agents as As_2O_3 and Sb_2O_3. Experiment did not confirm the merits claimed for ammonia. Further improvement may be expected along the line of finer suspensions.

Emulsifying Agents. Robert C. Smith. *Journal of the Society of Chemical Industry,* Aug. 12, pp. 345-6T. A standard method for estimating the dispersing power and efficiency of emulsifying agents is described. It depends on measuring amount of emulsion, unused dispersing agent and undispersed material under specified conditions. A more rapid and convenient method, based on estimation of the "dispersion factor," is applicable to most cases.

Straw. H. du Boistesselin. *Revue generale des matieres Plastiques,* Sept., pp. 547-53. The supply of straw still far exceeds the demand, although it has several potential markets. It yields sugar by acid hydrolysis; it makes satisfactory cheap paper pulp for certain uses; it is a cheap raw material for making pyroxylin and the cellulose esters. Methods of making and using some of these straw products are described.

Alkali Chlorides. Jean Billiter. *Zeitschrift für Elektrochemie,* Sept., pp. 353-60. A discussion of modern practice in keeping costs down and current efficiency up in the electrolysis of aqueous alkali chlorides. Outlets for chlorine are considered. One of the most promising potential uses is in the making of cellulose, a new development now under way in Italy. One factory is using chlorine water; another is using the gas.

Insulation. A. Guentherschulze. *Zeitschrift für Elektrochemie,* Sept., pp. 360-8; discussion, pp. 368-9. The subject of insulation materials is introduced by presenting the theory of insulating action. Properties essential in successful insulators are outlined, and the materials best suited to specific uses are discussed. A distinction is made between true and pseudo dielectrics. Much progress is anticipated along the line of purifying natural materials to improve their electrical resistance.

Corrosion. A Thiel. *Zeitschrift für Elektrochemie,* Sept., pp. 370-86; discussion, pp. 387-8. New experiments are reported which are based on the theory that corrosion is a strictly electrochemical problem. The results tend to confirm the local element theory and to support the diffusion theory as an auxiliary. Over-voltage studies, carried out with extreme systematic precision with respect to rates of gas formation, are important. Another important problem is the preparation and study of extremely pure metals. Corrosion research is still in its infancy.

Acetone Oils. Hermann Suida and Hans Poell. *Monatshefte für Chemie,* Aug., pp. 167-92. The composition of commercial acetone oil, as revealed by fractionation and analysis, indicates that a cracking process, increasing in intensity with increasing severity of conditions, is responsible for the numerous homologous and isomeric ketones of which the oil is chiefly composed. This research, with its clear exposition of experimental procedure, should be studied by all who are interested in quantitative examination of crude by-product mixtures.

Passive Chromium. W. J. Mueller and E. Noack. *Monatshefte für Chemie,* Aug., pp. 293-313. For every Cr anode there is a critical current density, above which the anode becomes passive. The change is quite analagous to the formation of passive Fe. The critical current density is related to the temperature by a logarithmic function. Oscillographs were taken to confirm the observations and to furnish data for plotting current density against voltage.

Fish Oil Fuel. Georges Lumet and Henri Marcelet. *Comptes rendus,* Aug. 17, pp. 418-20. Experiments were made with 4 fish oils, 6 marine animal oils and a sample of squalene, as fuels in a Diesel-Hindl type motor. Oil consumption was slightly greater than with gas oil, for approximately the same power output. Engine performance was slightly better than with gas oil. The principal difficulty is the relatively high viscosity as compared with gas oil. Marine oils make a satisfactory fuel for Diesel and semi-Diesel motors if properly used.

Soya Bean Oil. Andrew K. Schwartz. *Oil and Fat Industries,* Aug., pp. 284-8. Illustrated description of the continuous elevator type of extractor and its application to soya beans.

Stainless Steels. B. Strauss. *Zeitschrift für Elektrochemie,* Aug., pp. 317-21. An illustrated account of the development, properties and uses of the chrome-nickel steels. Much of the industry at Solingen is concentrating on the non-rusting steels.

Transport Tank. *Industrial Chemist,* July, p. 294. Illustrated description of a successful tank truck, made of malleable nickel, for hauling alkaline liquids. The nickel is made in a Heroult furnace, with prescribed limits of C and S content, and sufficient Mg to prevent oxidation is added just before casting.

Explosives. *Industrial Chemist,* July, pp. 297-307. Illustrated description of methods and machinery used in the manufacture of nitroglycerin, nitrocellulose, TNT, tetryl, cordite, ballistite and sporting powders at Nobel's Ardeer factory.

Insecticides. F. Tattersfield and C. T. Gimingham. *Journal of the Society of Chemical Industry*, Sept. 9, pp. 368-72T. A report of research on the relative toxicity and practical merits of some natural plant products and some synthetic organic compounds as contact insecticides. In the fatty acid group, the most toxic compound so far found is undecenoic acid. Most soaps are less toxic than the free acids, but some ammonia soaps are more toxic. Some progress has also been made with quaternary bases.

Turpentine Substitutes. Felix Hebler. *Farbe und Lack*, Sept. 7, pp. 472-3. All known substitutes for turpentine are much inferior in the property of peptising or swelling wax emulsions. Turpentine oils show considerable variation among themselves, but are always more effective than the substitutes. In general, freshly distilled oil is less active in peptising than older (partly resinified) oils. The peptising test can be used to detect adulteration. Illustrated with photomicrographs.

Alcohol Rectification. L. Gay. *Chimie et Industrie*, Aug., pp. 187-203. Gay's studies on the principles of fractional distillation are illustrated by the case of separating a mixture of ethyl, propyl, butyl and isoamyl alcohols. Curves are shown for all the binary mixtures of this system, plotting heat flux against mol per cent of liquid phase of the less volatile component. Fractionation charts are also given for this complex separation.

Dyeing. Paul Pfeiffer and Liu Wang. *Zeitschrift für angewandte Chemie*, Sept. 1, pp. 983-91. To illustrate the theory of the dyeing of wool and silk, the use of sarcosin anhydride with naphthols and other phenolic compounds is discussed. Temperature-composition charts are shown, to indicate the chemical relations of sarcosin anhydride to the phenols.

Coke. G. Agde and H. Schmitt. *Zeitschrift für angewandte Chemie*, Sept. 8, pp. 1003-8; Sept. 15, pp. 1027-32. A detailed experimental study of the reducibility of coke. Previous work is critically reviewed; methods of measuring reducibility, plotting the curves and determining the individual factors involved are described. The general conclusion is that the wide variations in reducibility are due partly to chemical composition and partly to surface characteristics.

Coking Briquets. Andre Leaute. *Comptes rendus*, Aug. 22, pp. 465-7. Experiments were made on low temperature coking of long flame coals briquetted with a tar or oil from coal. A method is described which yields 2 to 15 per cent of gas (according to conditions), about as much oil as was used in briquetting, and a very hard, compact coke.

Weighing. W. A. Benton. *Chemistry and Industry*, Aug. 19, pp. 741-4; Aug. 26, pp. 764-7. The problem of weighing in the chemical industries is considered with respect to accuracy and commercial efficiency. Laboratory and assay balances, platform scales, visible weighers, automatic feed weighers and a new automatic steam condition-testing plant are described and illustrated.

Colored Ketones. R. Wizinger. *Zeitschrift für angewandte Chemie*, Aug. 18, pp. 939-45. The cause of color of the deeply colored ketones (indigo, indanthrene and others) is now linked with the cause of color in ketone imides, Schiff bases, stilbene and other phenylated ethylenes, etc. A modified auxochrome theory is proposed which, with the Dilthey chromophore theory, places all these compounds in the same color class, including many dyes which have the characteristic unsaturated central atom in the ionic state.

Wood Preservation. R. Falck. *Zeitschrift für angewandte Chemie*, Aug. 18, p. 962. Fluorides, silicofluorides and compounds of As are the most successful poisons for commercial wood treating; but they leach out too easily. It has been found that leaching out can be greatly retarded by combining the poisons with certain color bases which stain wood, without sacrificing the fungicidal and insecticidal properties.

Refining Glucose. W. Taegener. *Chemiker-Zeitung*, Aug. 31, pp. 669-70. Eponit, a steam activated charcoal, is the only satisfactory substitute for boneblack in clarifying glucose. It can be used either by the layer filtration or the doughing-in method. Both methods, and their equipment, are described and illustrated.

Metals and Alloys. Albert Portevin. *Bulletin de la Societe Chimique*, Aug., pp. 961-87. A lecture on crystallization and structure in iron, steel and certain alloys. Illustrated with some remarkable photographs of fractures and etched surfaces of brass castings, ferronickel, steel and the like, showing grain, fibrous and crystal structures, slip bands, etc.

Artificial Petroleum. A. Mailhe. *Bulletin de la Societe Chimique*, Aug., pp. 1056-61. By distillation of Japan wax or carnauba wax in presence of $ZnCl_2$, hydrocarbons closely resembling petroleum can be obtained. They can be separated into gasoline, kerosene, heavy oil and paraffin fractions; and the higher fractions can be cracked to form light oils and hydrocarbons, clear down to methane and ethylene. Further distillation, accompanied by cracking and repolymerization, leads to carbon-rich oils and finally to pitch.

Alkali-Proofing Concrete. E. C. E. Lord. *Public Roads*, Aug., pp. 105-12. Report of tests by the Bureau of Public Roads on tar and paraffin treatments in the laboratory and on certain bridges and dams. Illustrated with photographs and tables of data.

Cylinder Oils. J. W. Donaldson. *Journal of the Society of Chemical Industry*, July 29, pp. 324-7T. There is only a very general relation between the physical tests of an oil and its volatility and carbonization behavior. In general, light oils deposit less carbon, and the lightest oil consistent with good lubrication and temperature control should be used in the least permissible quantity.

Government Publications

Prices indicated are charged by the Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for issue.

United States Government Master Specification for Lubricants and Liquid Fuels, and Methods for Sampling and Testing. Revised October 21, 1927. Bureau of Mines Technical Paper 323B. 15 cents.

Census of Dyes and Other Synthetic Organic Chemicals, 1926. Tariff Commission Tariff Information Series No. 35. 30 cents.

Market Research Agencies—A Guide to Publications and Activities Relating to Domestic Marketing, 1927 Edition. Bureau of Foreign and Domestic Commerce, Domestic Commerce Series No. 6. 15 cents.

Progress of Fuel Economy at Petroleum Refineries in the United States, by G. R. Hopkins. Bureau of Mines Serial 2829.

Quality of the Surface Waters of New Jersey, by W. D. Collins and C. S. Howard. U. S. Geological Survey Water-Supply Paper 596-E. 5 cents.

Production statistics from 1925 Census of Manufactures — printed pamphlets on: Paints and Varnishes, Bone Black, Carbon Black and Lampblack; Wood Distillation and Charcoal Manufacture; and Chemicals—Chemicals Not Elsewhere Classified, Sulphuric, Nitric and Mixed Acids, Rayon and Salt.

Mineral production statistics for 1926—separate pamphlets from Bureau of Mines on: Antimony, by J. W. Furness; Arsenic, by V. C. Heikes; Bauxite and Aluminum, by James M. Hill; Selenium and Tellurium, by V. C. Heikes; Barite and Barium Products, by R. M. Santmyers and A. Stoll; Salt, Bromine, and Calcium Chloride, by A. T. Coons; Platinum and Allied Metals, by James M. Hill; Tin, by J. W. Furness; Asphalt and Related Bitumens, by G. R. Hopkins; and Gold, Silver, Copper, Lead, and Zinc in the Eastern States, by J. P. Dunlop. 5 cents each.

Mineral production statistics for 1925—separate pamphlets from Bureau of Mines on: Gold, Silver, Copper, Lead, and Zinc in Colorado, by Charles W. Henderson, 5 cents; Gold, Silver, Copper, Lead, and Zinc in Nevada, by V. C. Heikes, 10 cents; and Gold, Silver, Copper, Lead, and Zinc in Montana, by C. N. Gerry. 10 cents.

Sulphuric Acid and Acid Phosphates Produced, Consumed, Sold, and in Stock—The Fertilizer Industry: 1927, First Six Months. Mimeographed statistical statement from the Census of Manufactures.

Paint and Varnish Production and Sales: 1927, First Six Months. Mimeographed statistical statement from the Census of Manufactures.

THE PLANT NOTEBOOK

an exchange for OPERATING MEN

Experimental Electrical Rotary Calciner

By J. A. Murray
U. S. Bureau of Standards

Editor's Note: *The description of this piece of experimental apparatus is presented by permission of the Director of the Bureau of Standards in the realization that the operating engineer is frequently confronted by similar problems.*

An investigation made by the Bureau of Standards required calcination of gypsum at various rates and at various limiting temperatures. Since electrical heating affords close control of the rate and temperature of calcination, a rotary electrical calciner was built which provided continuous agitation and prevented localized over-heating.

The calciner shown in the illustration consists of a drum, 10 in. in diameter, 16 in. long, made from No. 14 ga. sheet brass. The ends are machined brass plates, to which the drum is attached by screws so that it may be disassembled in case a heating unit is to be replaced. The supporting and driving shafts do not pass through the drum but are attached to end plates. The apparatus is gear driven by a small motor through a speed reducer. An opening, 6 in. sq., for charging and discharging is provided with a cover attached by thumb screws. The sides of the instrument and the cover for the opening are insulated with asbestos.

Three valves are provided for steam outlets. These are automatically opened as they approach the top, by the metal strip shown at the left of the drum in the photograph. At the bottom they are held closed by springs. Experience with a previous model showed that when only two valves were used, a pressure was created in the drum during a short interval in the cycle when both valves were closed. As a result, some of the contents were blown out when a valve reopened. This difficulty was avoided by using three valves, thus making it impossible for all three valves to be closed simultaneously.

Four electrical units are used for heating. These are made from a porcelain core, wrapped with resistance wire such as is used in electrical furnaces. A brass tube encloses the units so that no contact occurs between the gypsum and the heating element. Electrical contact between the tubes and heating elements is prevented by supporting them concentrically at the ends.

One end of the drum is provided with a single slip ring, the other with two, all mounted on bakelite. The four units are connected to the single ring at one end; at the other end, two units are connected to one ring, the remaining two are connected to the second ring. By means of switches the four heating units may be arranged in three ways, viz., all four in parallel, four in series parallel, or two disconnected and the remaining two used in parallel. An external slide wire resistance is provided to obtain still closer control of current input.

The power consumption of the apparatus may be varied from 170 to 1400 watts, using 110 volt, direct current. Temperature measurements are made by means of a thermometer inserted through a hollow shaft at one end. The capacity of the instrument is 12 kg. of ground gypsum rock. Its efficiency, calculated from the electrical input and the thermal constants for gypsum varies from 20 to 60 per cent, being greater in the cases where more power and consequent shorter time of calcination are used.

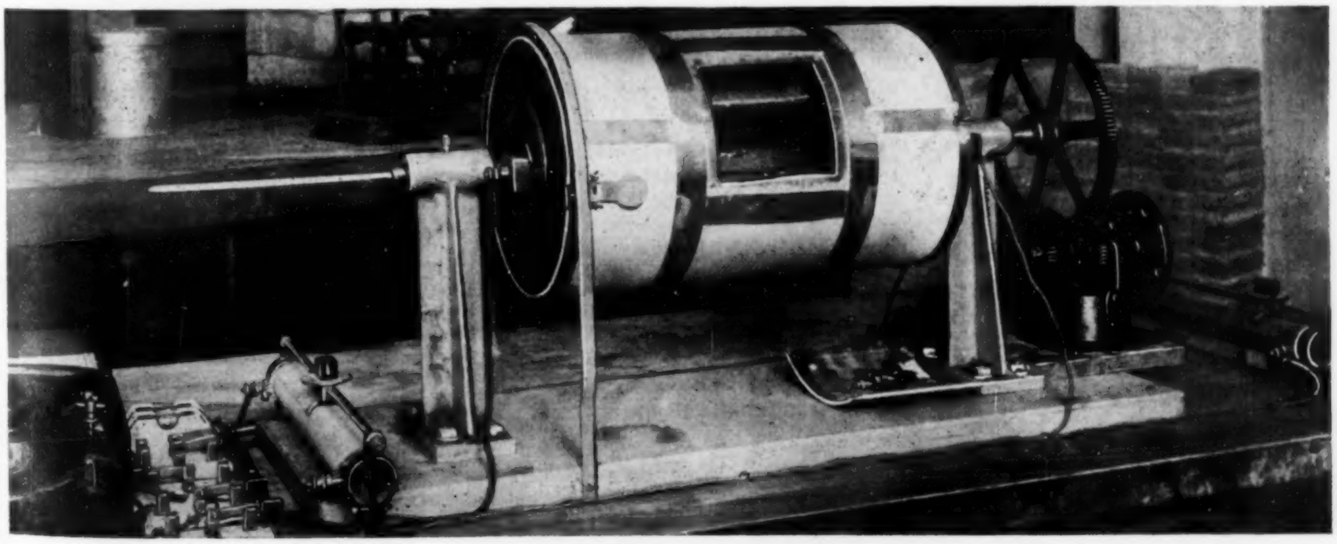
With a little experience the temperature may be controlled very closely. It was found possible to follow a predetermined time-temperature curve with considerable accuracy, and to hold the temperature constant within one or two deg. at any point. Consequently the instrument is entirely satisfactory for the purpose for which it was designed.

Drum Caustic Dissolver

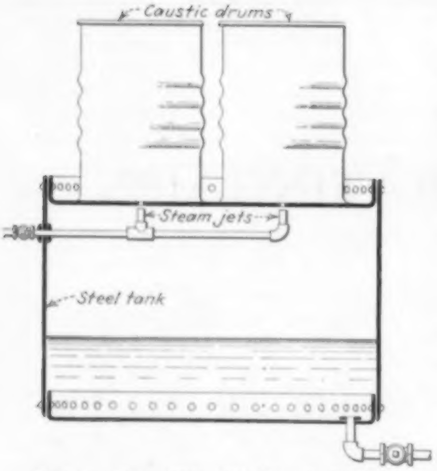
By L. C. Cooley
Swenson Evaporator Company

More than one laborer who once forgot to wear his goggles when he broke up a drum of solid caustic soda with a 10-lb. sledge, has had occasion to remember this safety precaution ever since. The practice is not only dangerous, but it is also a big time-consumer and easily conducive to "soldiering" on the part of the laborer.

Many plants have solved the problem



Experimental Electrical Rotary Calciner
This instrument was built and used by the Bureau of Standards in an investigation of the calcination of gypsum.



Simple Dissolver for Drum Caustic

in a manner similar to that shown in the drawing. The idea is extremely flexible and requires only some means of supporting the drums over steam jets together with a tank for collecting the solution. It is always advisable to have a small amount of water in the tank bottom to avoid recrystallization of the melted caustic upon cooling. One simple set-up that suggests itself is to sink the tank below the floor and cover it with a flush metal grating upon which the drums may easily be rolled without any lifting.

Protecting Aluminum By Anodic Oxidation

By Peter Hagen
Gloucester, N. J.

Various methods have been developed for the treating of aluminum and its alloys in an effort to combat corrosion. The most successful method which has been discovered is that of anodic oxidation. It has the advantage that very complete protection is afforded without sacrificing any of the desirable physical properties of the aluminum or aluminum alloys.

Each piece subjected to the treatment must be submerged in the electrolyte bath for a period of approximately one hour. The system which is described herein requires but one dipping; and where the parts are small, greatly simplifies procedure by permitting the handling of a considerable number of pieces simultaneously.

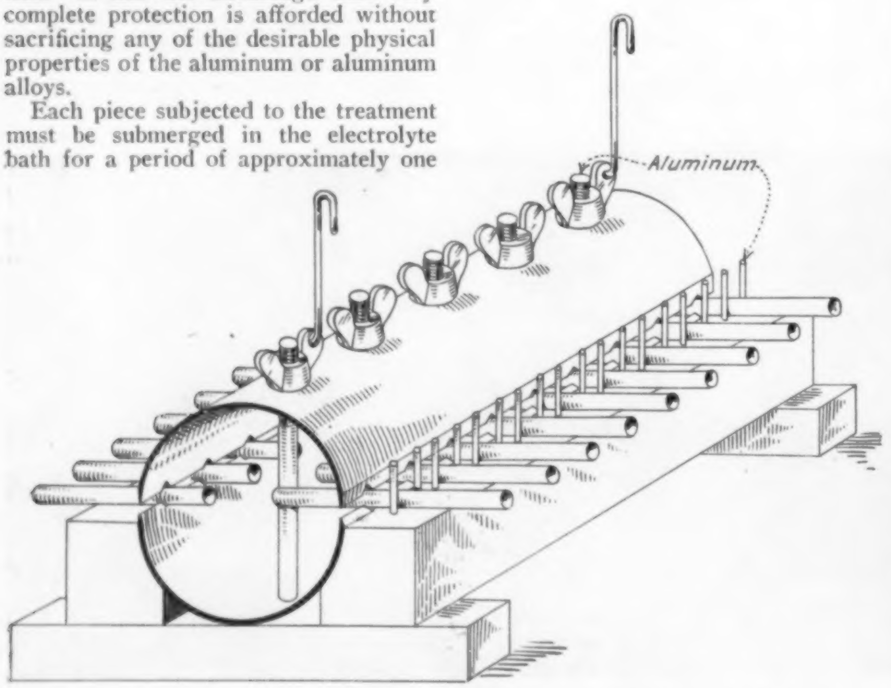
Before describing the apparatus which was developed to meet the requirements of group handling, it will be desirable to note a number of general principles:

In the first place, it must be remembered that dissimilar metals cannot be treated at the same time. For this reason any metals used in the apparatus for supporting the pieces treated must be of aluminum. If steel or brass should be used, the anodic film would not form near the contact points.

Every piece must be thoroughly cleaned to remove all grease and foreign matter before treatment, to insure continuity of the protecting film.

As soon as the parts are removed from the chromic acid bath after the treatment, they should immediately be washed very thoroughly in water to remove the last traces of the bath. They should then be dried by any means at hand; by the use of a dryer if one is available. While they are still clean, the pieces should be immediately varnished as a protection against damage to the anodic film during subsequent handling and assembly of the parts. It should be noted that the pieces may be heat-treated if necessary before the varnish coating is applied. Heat appears to have no appreciable effect upon the anodic oxide film.

A clamp which was developed for the simultaneous treatment of small aluminum studs is shown in the illustration. While the construction is evident, a number of points should be mentioned. The clamp may be made any reasonable length dependent upon the size of tank available and the number of pieces to be treated. A sheet of aluminum is rolled to semi-circular cross-section and supported in a wooden frame-work, thus forming the lower portion. A similar piece forms the upper. The edges should be notched to hold the parts and filed thin to give negligible area at the points of contact. Aluminum pegs may be inserted in the frame to assist in assembling. The clamp is drawn up and held together by means of aluminum through-bolts and wing nuts. The entire assembly is then suspended to the proper bath depth from the metal anode bar spanning the bath tank, by means of the hooks shown. With the metal tank made the cathode, the oxidation may thus easily be carried out.

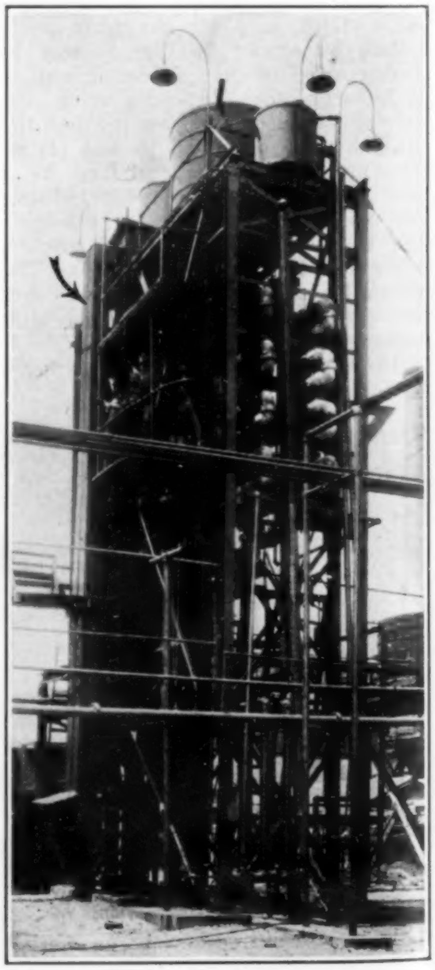


Clamp for Holding a Number of Aluminum Pieces for Simultaneous Anodic Oxidation

Gage-Reading Periscope

By W. E. Callahan
Sharples Solvents Corporation

In the chemical plant it is of frequent occurrence that some indicating instrument such as a pressure gage, gage glass, thermometer or weir box is, of necessity, located in an inaccessible place. We have found that this difficulty may be easily remedied through the use of periscopes such as the one indicated with the arrow in the photograph below. The periscopes are easily made on the job from seven-eighths lumber with cheap mirrors set at the proper angle at either end.



Easily Constructed Periscope Used to Read an Inaccessible Gage Glass

Equipment News from Maker and User

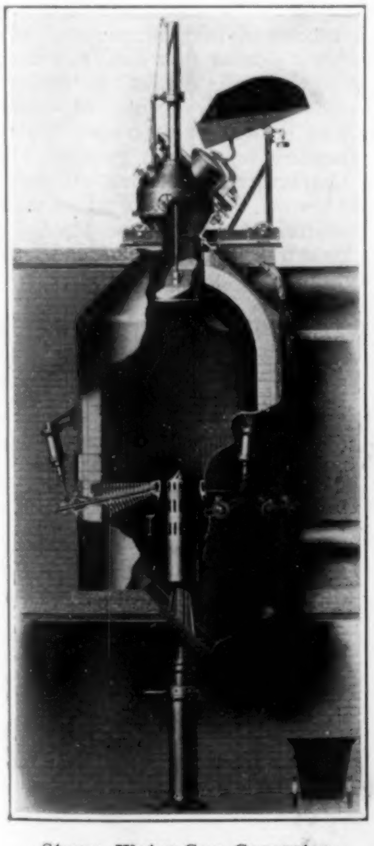
Automatic Water-Gas Generator

A recent development which has been made by the Semet Solvay Engineering Corporation, 40 Rector St., New York, has been shown in the introduction of the Steere completely automatic water-gas generator. The makers are ready to supply complete machines if desired, or will provide sufficient equipment to make any existing generator entirely automatic.

The three features which accomplish automatic fueling and care of the fire bed, are shown in the phantom view. They consist first, in the automatic charging machine which is said to maintain a uniform depth of fuel bed without difficulty. The charger weighs the fuel and distributes it at the edge of the generator at the point desired. The second automatic feature is shown flush with the center of the grate. This is a hydraulically operated grate poker which is used to break up clinker, close blowholes and open up the center of the fuel bed, and otherwise maintain uniformity and complete combustion.

The third step in automatic operation is the mechanically operated grate which is intermittently rotated by hydraulic cylinders. The grate segments which radiate from the center of the generator may be so controlled that adjacent segments rotate toward each other, thus crushing the clinker and discharging it to the ash hopper below from which it may be withdrawn at will. Alternate rotating cycles are in reverse directions.

An experimental installation of the machine at the plant of the Pontiac, Mich., gas works has shown that the machine need not be opened except for the removal of ashes from the hopper; and except at rare intervals when side-wall clinkering has built up to an objectionable point.



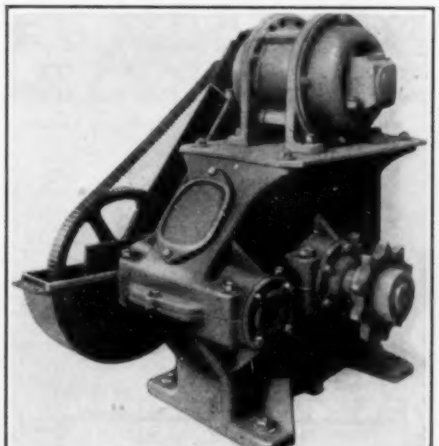
Steere Water-Gas Generator

Water-gas generator operation has been made completely automatic through the use of a hydraulically operated grate and poker and a mechanical charging device.

Speed Reducer

The H. W. Caldwell and Son Company, Western Ave. at Seventeenth St., Chicago, a subsidiary of the Link-Belt Company, has recently placed upon the market a new self-contained Caldwell Speed Reducer which is made in two styles. Type "A," illustrated herein is designated as a general purpose reducer with ratios ranging from 7:1 up to 40:1. Type "B" which is adapted for use in direct connection with a screw conveyor is supplied in ratios from 7:1 to 30:1.

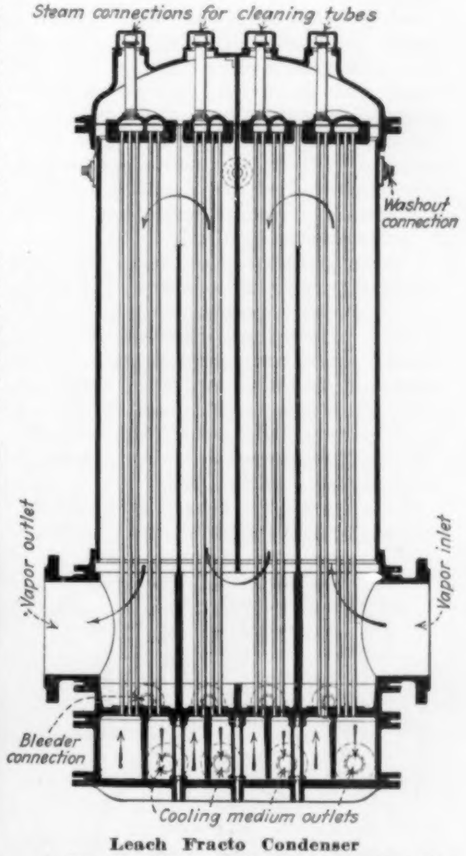
The reducer has the advantages that little floor space is required and that the motor is always properly lined up without the use of a flexible coupling. The motor is supplied with the reducer and drives a spur gear reduction unit running in oil, through a Link-Belt silent chain. Ratios are easily changed by substituting different silent chain pinions. The spur gear shafts are equipped with Timken roller bearings lubricated automatically from the housing reservoir in the reducer base.



Caldwell Self-Contained Speed Reducer

New Fractionating Condenser

The Leach Fracto Condenser, which is made by the C. H. Wheeler Company of Philadelphia, is essentially a condensing column, designed in such a manner as to separate the condensate into several fractions. It makes use of the feed stock as a cooling medium for the recovery of a large amount of process heat. It consists of an outer shell of cast iron or steel plate of circular section, approximately ten feet in height and five feet in diameter. Within this shell are a number of tubes of a size calculated to balance velocity of flow against possibility of fouling. These tubes extend vertically from a heavy



Leach Fracto Condenser

A fractionating condenser which has the advantage of being adapted to the use of cooling media at different temperatures in its various sections. It is, in effect, a number of condensers within a single shell

base or channel casting and are expanded into several floating heads at the top of the condenser to relieve stress due to uneven expansion and contraction. This method of construction precludes the possibility of damage when using cooling media of widely separated temperature. The cooling medium (or media) passes through these tubes, the vapor condensing upon their outer surfaces.

The channel casting referred to above contains a tube sheet into which the tubes are rolled. The top of this casting has integral basins formed upon it in which the distillate fractions collect and from which they are drawn through bleeder pipes. The tubes extend through the casting and communicate with the compartments at the bottom from which the cooling media are controlled.

On the lower flange of the channel casting are a series of covers, used to control the path of the cooling medium. Re-arrangement of these openings makes it possible to provide for the use of several combinations of cooling effects without danger of contamination through intermingling. The fractional control of the cooling media accomplished in this manner is said to aid in condensing the vapors into the fractions desired. These fractions are then drawn off from a series of bleeder pipes extending from the condensate basins. The condenser therefore lends itself to use in refineries, since each fraction may be sampled and directed to a separate tank, thus reducing treating and re-running operations.

Within the condenser shell and between the blocks of tubes are several vertical baffles to direct the flow of the vapor and to create several compartments for the fractional condensation of the distillates in the vapor. The temperature of these various compartments may be controlled by adjusting the flow of the cooling medium or by use of two or more cooling media.

Covers placed on the top of the condenser provide easy access to the tubes for cleaning, repairing or inspection without disturbing cooling medium, bleeder or vapor connections. These covers also allow for easy retubing. Blow-off plugs in the head permit a steam connection to be made to any bank of tubes should fouling make it necessary.

The apparatus has been designed for use with both vacuum and pressure stills. The liquid spaces are built to withstand any vacuum as well as working pressures up to 1,500 lb. per sq.in. Vapor spaces provide for pressures up to 150 lb. and any degree of vacuum. The vapor passes and vapor inlet and outlet are of sufficient area to reduce back pressure on the still and to handle the increased volume of vapor on distillations under reduced pressure.

The design of the Leach condenser has been planned to reduce or to eliminate corrosion within the shell. Small tubes are used to increase the velocity of flow of the cooling media and decrease the film thickness. The contraflow design and the long travel are both contributory to a low outlet temperature of any non-condensable material with consequent maximum heat transmission from each bank of tubes. The condenser is not designed to supplant bubble towers. It is intended to be used in connection with a bubble tower to reduce the work required from the latter and to permit the use of a lesser number of trays.

The manufacturers claim excellent heat recovery as well as large savings in cooling water and in re-runs. The condenser is said to be applicable to all distillation processes requiring the separation of the distillate into several fractions. The factor of heat exchange between distillate and feed stock makes its employment attractive to any industry depending upon distillation in any phase of its flow sheet.

Segment Roll Pulverizer

It has been said that there are but four principles which combine to produce a well designed disintegrating machine. These four principles of pressure, impact, attrition and a free discharge of the product, have been combined, the makers state, in the new Brainard Segment Roll Pulverizer, made by the Brainard Pulverizer Company, 330 Old Colony Building, Chicago.

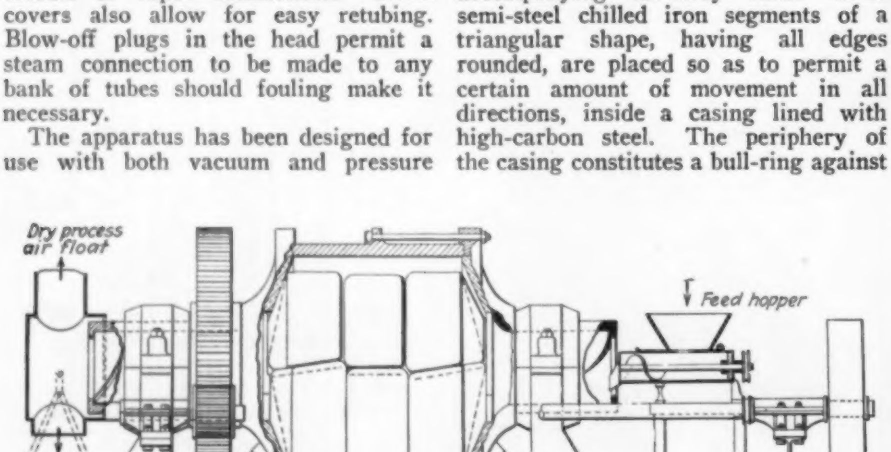
The pulverizer is illustrated in the accompanying cut-away view. Nine semi-steel chilled iron segments of a triangular shape, having all edges rounded, are placed so as to permit a certain amount of movement in all directions, inside a casing lined with high-carbon steel. The periphery of the casing constitutes a bull-ring against which the segments slide and strike as the casing is slowly revolved. This results also in pressure, impact and attrition between the various segments. Attrition takes place both in a circumferential direction and along the axis of the machine.

Material is fed to the machine by means of the hopper at the right, from which it falls to a screw feed mechanism discharging through a hollow shaft into the casing. A continuous current of air induced by a fan at the discharge end picks up the properly reduced material and removes it when formed. The pulverizer may be equipped for either open or closed air circuit operation, and is said to be adaptable to wet grinding.

The makers advocate the use of the machine for all kinds of abrasive material such as silica and cement clinker, as well as for adhesive materials such as talc and kieselguhr. Applicability is also claimed in wet pulverizing. The pulverizer is suitable for production up to four tons per hour. It is said that little power is required, since, as the weight of the segments is carried high, the machine is very nearly balanced.

Oil Blend Calculator

The C. J. Tagliabue Mfg. Company, 18 Thirty-third St., Brooklyn, has introduced a new device for use in oil laboratories which the manufacturers have called the TAG-Isom Blending Calculator. The instrument is shown in the accompanying illustration to be somewhat similar to a slide rule both in appearance and in operation. Scales are provided whereby blends of different oils may be made either upon the basis of viscosity or specific gravity. With the characteristics of one oil and the blend known, those of the added oil may be determined. Or if the blended oils are known separately, the blend may be determined.



Brainard Segment Roll Pulverizer

The TAG-Isom Calculator For Blending Oils

One side of the calculator carries gravity scales, both in deg. A.P.I. and in specific gravity. On the reverse side are viscosity scales referred to oils both at 100 deg. and 212 deg. F. The makers claim the advantages that the calculator is rapid and simple to use and more accurate than charts.

Corrosion-Proof Pipe

The Brown Company, Portland, Me., has developed as the result of a number of years of research work, a compressed wood fiber pipe which has been impregnated under pressure with boiling pitch. The new product which is called Bermico Mine Pipe was originally intended to replace iron pipe where acid mine waters were a factor. Since however, the pipe is not affected by acids, alkalis and electrolysis and can be used with liquids at a reasonably elevated temperature, the product is said to have possibilities in the chemical industries. Rust and scaling are eliminated with the result that the claim is made that the pipe remains free-flowing over protracted periods.

Bends, elbows and tees may also be obtained in this material. Sizes are available in 2 in. to 6 in. inside diameters. Joints are made without contact between the pipe contents and metal. Fiber collars pressed and pinned to the pipes are held securely in contact with each other, separated by rubber or fiber gaskets, by means of long through-bolts of Ascoloy Metal. No special tools are required in assembling the joints. After assembly, as a further protection, the heads of the bolts are pitch-coated, thus producing an impervious and resistant whole.

Push-Button Station

The General Electric Company, Schenectady, announces a new time-delay push-button station for use in preventing the cutting out of motors controlled by magnetic starters, when there is a brief power disturbance. This station makes it unnecessary to add time-delay attachments to the starters themselves. When the power fails the magnetic starter will drop out, but will be caused to reclose upon the return of voltage by the device, unless the time for which the push-button station is set is exceeded, when the "Start" button must be pushed to energize the magnetic starter and so restart the motor.

In operation, pressing the "Start" button of the push-button station closes the pilot circuit of the magnetic starter and also the circuit of a coil in the push-button station. This coil is part of a "lift" solenoid and, when energized, causes the solenoid plunger to rise. At the bottom of the plunger are spring-attached contacts which are closed by the lifting action, thus maintaining the circuit through the solenoid itself and also the pilot circuit of the magnetic starter with which the device is used.

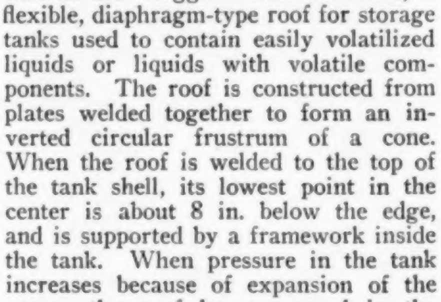
When voltage drops sufficiently to permit the solenoid to release the plunger, the latter starts to fall but is retarded in its downward movement by a rack which turns a gear. The gear engages a ratchet which can be adjusted for a maximum of 1½ seconds by means of a heavy nut at the end of the rod which serves as a pendulum. If power does not return before the time expires for which the device is set, then the contacts will be opened and both the solenoid and the magnetic starter will be disconnected until the "Start" button is again pushed.

Pressing the "Stop" button stops the motor immediately, because this action opens the pilot circuit of the magnetic starter and likewise disengages the rack of the solenoid plunger so that the latter falls instantly.

Wiggins Breather Roof for Storage Tanks

The Chicago Bridge and Iron Works have recently announced the introduction of the Wiggins Breather Roof, a flexible, diaphragm-type roof for storage tanks used to contain easily volatilized liquids or liquids with volatile components. The roof is constructed from plates welded together to form an inverted circular frustrum of a cone. When the roof is welded to the top of the tank shell, its lowest point in the center is about 8 in. below the edge, and is supported by a framework inside the tank. When pressure in the tank increases because of expansion of the vapor, the roof bows upward in the middle, increasing the vapor space.

When the tank is filled nearly full with a volatile liquid, any variation in the pressure in the vapor space above the liquid due to atmospheric temperature will be followed by the roof without loss of vapor. In the case of ordinary standing-storage tanks, considerable of the volatile portions of the contents are lost as the vapors expand during the day and the pressure is relieved by the vent. The Wiggins roof, however, does not vent the tank to the atmosphere unless the pressure should become dangerously great due to an abnormally high air temperature and a very large vapor space.



Wiggins Breather Roof

This diaphragm roof prevents the lost of volatile liquids by eliminating the necessity for venting the tank to the air.

The Sirocco Collector, which is Designed to Precipitate Exceedingly Fine Dust

Sirocco Dust Collector

With the recent introduction into this country of the Sirocco Dust Collector, made by Davidson and Company, Ltd., Belfast, the United States agents, the American Blower Company of Detroit, are offering to power plants and to other industries having dust problems, a device which they claim has solved the ash and soot nuisance. Even where stoker fired boilers are used, this has always been a problem in congested centers; and the present greatly extended use of powdered fuel has increased the difficulty.

The Sirocco collector is of the centrifugal type and is so designed as to create the centrifugal separating action without turbulence and without interrupting the outward and downwardly revolving paths of the suspended particles of solid matter.

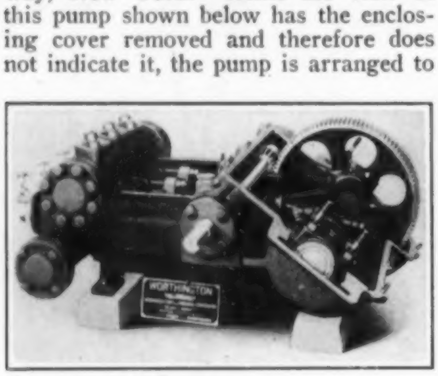
Tests are said to have shown collecting efficiencies which compared favorably over a wide range of volumetric capacities and dust concentrations, with both dust filters and electrical precipitation methods. A surprising feature of the separating action is that the relative fineness of the dust particles is not, apparently, a governing factor in obtaining high efficiencies with the collector.

While this device has found its greatest use among power plants, in the collection of cinders and fly-ash suspended in the stack gases and in the recovery of coal dust arising from the preparation of powdered coal, nevertheless, it has

also been applied with success in the collection of a variety of fine dusts. The agents tell of one interesting case in which the tar from a producer gas plant was so contaminated with dust in the gases that it refused to flow in pipes. Settling chambers failed to relieve the difficulty, which was eventually entirely overcome through the installation of Sirocco type "D" collectors.

Horizontal Triplex Pump

A new triplex power pump has been brought out by the Worthington Pump and Machinery Corporation, 115 Broadway, New York. While the view of this pump shown below has the enclosing cover removed and therefore does not indicate it, the pump is arranged to



Horizontal Self-Oiling Triplex Pump

be completely self-contained with the motor mounted above the casing, adapted to drive the pump through a chain. The special features of the pump are said to be the facts that all working parts are enclosed and impervious to dust, while a constant flood of lubrication is distributed to all points by the main gear. This gear carries oil from the crankcase reservoir to the top of the casing from whence it is distributed.

It is claimed that these features result in a pump which is practically free from maintenance. The pump is intended to run at 200 r.p.m. of the crankshaft and can be supplied in two sizes 2½ in. by 5 in. and 3½ in. by 5 in. The pump is of the outside packed type and to further increase accessibility, all valves may be reached without general dismantling.

Roof Ventilator

In an effort to provide a ventilation unit which will function without power as the usual type of roof ventilator under ordinary circumstances, but which can be made to take care of abnormal conditions satisfactorily, when they arise, the Burt Manufacturing Company of Akron, Ohio, has placed a direct-connected fan ventilator upon the market.

The new unit comprises in combination, a circular roof-type ventilator with a motor and propellor fan. The motor is provided with a non-metallic mounting to insure quiet operation. A fusible link is so arranged as to close the ventilator damper in case of fire. The makers are prepared to supply the ventilator in a variety of materials in order to withstand successfully the corrosive conditions met about the chemical plant.

Manufacturers' Latest Publications

Crouse-Hinds Company, Syracuse, N. Y.—Bulletin G-6; Folder No. 52; Advance Sheets Nos. 94 and 96.—These give data on electrical installation equipment and on safety hand lamps.

Norwood Engineering Company, Florence, Mass.—Folder No. 5—This describes the JameScreen which is now being made by this company.

General Electric Company, Schenectady, N. Y.—Pamphlets as follows: GEA-118A; CR2940 Push Button Station; GEA-152A Auxiliary Welding Resistors, Type AW; GEA-233A, Centrifugal Air Compressors; GEA-788, Type FT General Purpose Squirrel Cage Motors; GEA-796, Automatic Supervisory Equipment; GEA-813, Magnetic Reversing Switches for Alternating Current; GEA-817, Battery Charging Equipment; GEA-819, Horizontal Edgewise Instruments; GEA-820, Vertical Water-wheel-Driven Generators.

Combustion Engineering Corporation, 200 Madison Ave., New York, N. Y. — New publications as follows: Catalog FF-2 covering C-E Fin Furnaces; A reprint entitled "Firestone Remodels Furnaces for Pulverized Coal."

Dry Quenching Equipment Corporation, 200 Madison Ave., New York, N. Y.—Publocation S-1—A pamphlet which covers the dry quenching of coke.

International Nickel Company, 67 Wall St., New York, N. Y.—A new pamphlet on "Nickel in the Brass Foundry."

Electric Controller & Mfg. Company, Cleveland, Ohio.—New publications as follows: Bulletin 900, Lifting Magnets; Bulletin 940, Nickel Alloy Resistors; Bulletin 980, Controllers for Direct Current Motors; Bulletin 1004, Type WB Brakes.

Hardinge Company, York, Pa.—Mailing pieces describing Hardinge Mills and the Ruggles-Coles Dryer as well as the service of the subsidiary Steacy-Schmidt Mfg. Company.

Brown Instrument Company, Wayne & Roberts Ave., Philadelphia, Pa.—Bulletins No. 84-9 and 85-6 describing Brown instruments for automatic control.

W. S. Rockwell Company, 50 Church St., New York, N. Y.—New publications as follows: Bulletin No. 280, Continuous Annealing Furnace; Bulletin No. 281, Electric Furnaces; Bulletin No. 284, Continuous Heat Treating Furnaces; Bulletin 285, Car and Car-and-Roll type Heat Treating Furnaces.

Hills-McCanna Company, 2025 Elston Ave., Chicago, Ill.—Leaflet on "Hills-McCanna 45," a bronze with the strength of steel.

Esterline - Angus Company, Indianapolis, Ind.—Publications as follows: Bulletin 627, Recording Productive Work; Bulletin 827, Recording Unit for Surface Condensers.

Semet-Solvay Engineering Corporation, 40 Rector St., New York, N. Y.—Leaflets as follows: No. 320, Distribution of the Backrun Process; No. 321, Coal Gas Plants; No. 322, Gas Hardware; No. 323, Draft Control; No. 327, Steere Automatic Grate; No. 328, Steere Water-Gas Generator.

Terry Steam Turbine Company, Hartford, Conn.—Bulletin S-84—A new catalog which describes the Terry Turbine.

Swenson Evaporator Company, Harvey, Ill.—Catalog 127—Devoted to a description of Swenson Evaporators.

Fisher Scientific Company, 709 Forbes St., Pittsburgh, Pa.—New mailing piece covering apparatus for chemical, metallurgical and biological laboratories.

Foote Bros. Gear & Machine Company, 215 No. Curtis St., Chicago, Ill.—Catalog 400—"Moderntype" Worm Gearing. Also, a folder describing the A. Plamandon Disc-Type Friction Clutch.

New Departure Mfg. Co., Bristol, Conn. —New binder leaves as follows: No. 180, Ball Bearings for Vacuum Cleaners; Nos. 181 and 182, Ball Bearing Spindles for Light and Heavy Duty Grinders.

Central Alloy Steel Corporation, Massillon, Ohio.—New handbook on Agathon Enduro Stainless Iron.

The Witt-Humphrey Steel Company, Greensburg, Pa.—New booklet describing the use of "MetaLayeR" in the combating of corrosion.

Raymond Bros. Impact Pulverizer Company, 1315 North Branch St., Chicago, Ill. —A new pamphlet on "The Air Separation of Chemical Hydrated Lime."

Zaremba Company, Crosby Building, Buffalo, N. Y.—A new catalog describing Zaremba evaporators.

Merco Nordstrom Valve Company, 121 Second St., San Francisco, Calif. — Pamphlet describing the use of Merco Nordstrom Plug Valves in the following industries: Gasoline Extraction Plants; Petroleum Industry; Chemical Industry; Gas Industry; Cement Plants.

Taber Pump Company, Buffalo, N. Y.—Bulletin FN 827. A new mailing piece showing certain uses of Taber pumps.

Rollway Bearing Company, Inc., Syracuse, N. Y.—Bulletins 51 and 52—Bearings for crane hooks and roll neck service are described.

Silent Hoist Winch and Crane Company, Inc., 762-772 Henry St., Brooklyn, N. Y.—Bulletin 30—A new folder which describes winches, cranes and derricks for gasoline and electric motor trucks and tractors.

E. Leitz, Incorporated, 60 East Tenth St., New York, N. Y.—Catalog No. 1114—Describes the new model MC Metallographic Microscope with Camera.

American Manganese Bronze Company, Philadelphia, Pa.—Acid bulletin No. 1—A pamphlet describing metals which are resistant to the action of sulphuric acid.

Paige & Jones Chemical Company, Inc., Hammond, Ind. — A new bulletin on softened water and water-softening equipment.

Horace Hills, Room 1535, 315 Montgomery St., San Francisco, Calif.—A folder describing the new Starrett Cable Cutter.

General Refractories Company, 117 South Sixteenth St., Philadelphia, Pa.—A new folder describing the service of Arcofrax High Alumina Brick.

Mathieson Alkali Works, Inc., 250 Park Ave., New York, N. Y.—Bulletin No. 271 —A pamphlet which describes the use of caustic soda, soda ash, bicarbonate of soda and ammonia in the petroleum industry.

Atlas Lumnite Cement Company, 25 Broadway, New York, N. Y.—Brochure describing the use of Lumnite Cement for Winter Concrete.

Baker Perkins Company, Inc., 250 Park Ave., New York, N. Y.—Catalog No. 27, Werner & Pfleiderer Division—Booklet describing mixing and masticating machinery for the process industries.

Brown Company, Portland, Me.—New folder describing Bermico Mine Pipe.

Alsop Engineering Company, 47 West 63rd St., New York, N. Y.—Catalog M-2 —Two pamphlets which describe Hy-Speed Portable Electric Liquid Mixers.

Sturtevant Mill Company, Boston, Mass. —Leaflets describing Sturtevant Screens and Whirlwind Selectors.

Chicago Bridge & Iron Works, 37 West Van Buren St., Chicago, Ill.—A new catalog explaining the Wiggins Breather Roof.

Pyrene Mfg. Company, Newark, N. J.—A new leaflet announcing the Phomene Accumulator. This is a self-contained foam distributing system for fire protection.

Cambridge Instrument Company, Ltd., 45 Grosvenor Place, London, S. W. 1—Bulletin describing Cambridge Instruments for collieries.

Paul O. Abbé, L'ttle Falls, N. J.—New leaflet describing Abbé Pebble Mills.

Midwest Steel & Supply Company, Inc., Bradford, Pa.—New pamphlet describing Midwest 1-4 Concrete Inserts.

Elliott Company, Jeannette, Pa.—Bulletin T—A new booklet describing centrifugal blowers and compressors.

Sheet Steel Trade Extension Committee, Oliver Bldg., Pittsburgh, Pa.—Large catalog entitled "5000 Sheet Steel Products and Who Makes Them," a directory of the sheet steel industry.

American Concrete Pipe Association, 33 West Grand Ave., Chicago, Ill.—A new bulletin entitled "Concrete Pipe Sewers."

Denver Fire Clay Company, Denver, Colo.—A mailing piece describing Latite, a plastic refractory.

Republic Flow Meters Company, 2240 Diversey Parkway, Chicago, Ill.—New bulletin on furnace control instruments entitled "CO_2 and Fuel Economy."

Buffalo Foundry & Machine Company, Buffalo, N. Y.—Bulletin 220—Describing Buflovak Impregnating Apparatus and Vulcanizers. Bulletin 227 — Describing Buflokast Steam-Jacketed and Direct-Fired Kettles.

PATENTS ISSUED

Oct. 4 to Nov. 1, 1927

Paper, Pulp and Sugar

Treatment of Paper Pulp. Clarence R. Robinson, South Orange, N. J., assignor to Robinson Fibre Corporation, Wilmington, Del.—1,644,447.

Paper and Process of Making Same. Harold A. Smith, Passaic, N. J., assignor to The Hammersley Manufacturing Company, Garfield, N. J.—1,644,451.

Intermediate Bagasse Carrier for Cane-Sugar Mills. Jose Alvarez Perez, Central Francisco, Francisco, Cuba.—1,644,607.

Intermediate Bagasse Chute for Cane-Sugar Mills. Jose Alvarez Perez, Central Francisco, Francisco, Cuba.—1,644,608.

Apparatus for Paper Manufacture. Charles Wilbert Unkle, Baltimore, Ohio.—1,644,620.

Method of Bleaching Paper Pulp. Otto Kress, Appleton, Wis., assignor to American Lakes Paper Company, Chicago, Ill.—1,645,061.

Process and Apparatus for Treating Bagasse. Henry Istelli, Central San German, Oriente, Cuba.—1,645,242.

Method and Apparatus for Producing Paper Pulp. Wallace H. Howell, Jr., Willsboro, N. Y.—1,645,754.

Rope Paper-Carrier for Paper Machines. Joseph F. Thibedeau, Adelard Deguire, William Turner, and Archibauld McDermid, Espanola, Ontario, Canada, assignors to The Spanish River Pulp & Paper Mills, Limited, Espanola, Canada.—1,646,044.

Process of Purifying Liquids and Making Sugar. Eugene E. Battelle, New York, N. Y.—1,646,079.

Process of Desugaring Molasses. Guilford L. Spencer, Herricks, Me., assignor to The Cuban-American Sugar Co., New York, N. Y.—1,646,323.

Strainer for Sugar Juices and the Like. Samuel Stodole Peck, Honolulu, Territory of Hawaii.—1,646,556.

Apparatus for Disintegrating Sugar Cane. William Henry Morgan, Sr., Alliance, Ohio, assignor to William H. Morgan, Jr., Alliance, Ohio.—1,646,761.

Apparatus for and Method of Extracting Juice from Cane Stalks. William H. Morgan, Sr., Alliance, Ohio, assignor to William H. Morgan, Jr., Alliance, Ohio.—1,646,762.

Maceration Distributor for Sugar-Cane Mills. William G. Hall, Honolulu, Territory of Hawaii.—1,647,516.

Rubber and Synthetic Plastics

Process of Treating Rubber Latex and Product Obtained Thereby. Herbert W. Kelley, Winchester, and William D. Wolfe, Newton, Mass., assignors, by mesne assignments, to United Shoe Machinery Corporation, Paterson, N. J.—1,644,730.

Machine for Making a Fiber Composition. William G. O'Brien, Akron, Ohio, assignor to The Goodyear Tire & Rubber Company, Akron, Ohio.—1,645,068.

Cold Molding Composition Containing Orthocresol-Aldehyde Resin Binder and Process of Making Same. Carleton Ellis, Montclair, N. J.—1,645,693.

Apparatus for Electrical Vulcanizing. Joseph Ledwinka, Philadelphia, Pa., assignor to Edward G. Budd Manufacturing Company, Philadelphia, Pa.—1,645,704.

Process for the Manufacture of the Condensation Products of Urea and of Formaldehyde. Henri Barthélemy, Paris, France, assignor to The Societe Industrielle des Matieres Plastiques, Paris, France.—1,645,848.

Continually-Working Machine for Molding and Marking by Compression Plastic Materials. Vincent Llédo, Marseilles, France.—1,646,412.

Vulcanizing Apparatus. Roy D. Fritz, Akron, Ohio, assignor to The B. F. Goodrich Company, New York, N. Y.—1,647,040.

Rubber Product and Method for Producing the Same. Stephen G. Luther, Akron, Ohio.—1,647,184.

Heat or Vulcanizing Device. Roy W. Brown, Akron, Ohio, assignor to The Firestone Tire and Rubber Company, Akron, Ohio.—1,647,339.

Process of Vulcanizing Rubber and Compound Resulting Therefrom. Norman A. Shepard and Stanley Krall, Akron, Ohio, assignors to The Firestone Tire and Rubber Company, Akron, Ohio.—1,647,754.

Method of Treating Latex. John McGavack, Jackson Heights, N. Y., assignor to The Naugatuck Chemical Company, Naugatuck, Conn.—1,647,805.

Petroleum Refining

Method of Manufacturing Oil Gas. Robert D. Pike, San Francisco, Calif.—1,644,146.

Art of Continuous Distillation of Hydrocarbon Oils. James Ray Carringer, Elizabeth, N. J., assignor to Standard Development Company.—1,644,324.

Process of Carrying Out Chemical Reactions with Liquids. Eugene Hendricks Leslie, Ann Arbor, Mich., and Burnell R. Tunison, New York, N. Y.—1,644,736.

Vaporizer. Frank A. Milliff and John A. Milliff, Los Angeles, Calif.—1,644,937.

Process for Converting Oil. Walter M. Cross, Kansas City, Mo., assignor to Gasoline Products Company, Inc., New York, N. Y.—1,644,991.

Process of Refining Mineral Oils. Theodor Hellthaler, Granschutz, Germany, assignor to the Firm Hugo Stinnes: Riebeck Montan und Olwerke Akt. Ges., Halle-on-the-Saale, Germany.—1,645,530.

Treating Hydrocarbons. René de M. Taveau, Elizabeth, N. J., assignor, by mesne assignments, to The Texas Company, New York, N. Y.—1,645,553.

Petroleum-Refining Process and Reagent for the Removal of Sulphur. Frank C. Axtell, South Pasadena, Calif., assignor to Axtell Research Laboratories, Inc., Los Angeles, Calif.—1,645,679.

Apparatus for Completely Separating Gasoline from Mineral Oil. Arthur E. Pew, Jr., Bryn Mawr, and Henry Thomas, Ridley Park, Pa., assignors to Sun Oil Company, Philadelphia, Pa.—1,645,969.

Manufacture of Liquid Fuels. Martin Müller-Cunradi, Ludwigshafen-on-the-Rhine, and Wilhelm Wilke, Mannheim, Germany, assignors to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany,—1,646,014.

Treating Hydrocarbon Oils. Ralph C. Holmes, New York, N. Y.; Frederick T. Manley, Houston, and Otto Behimer, Port Arthur, Tex., assignors, by mesne assignments, to The Texas Company, New York, N. Y.—1,646,380.

Oil-Distilling Apparatus and Method. Edward C. D'Yarmett, Wichita Falls, Tex., assignor of one-half to O. K. Herndon, Kansas City, Mo.—1,646,448.

Oil-Distillation Process. Edward C. D'Yarmett, Kansas City, Mo., assignor of one-half to O. K. Herndon, Kansas City, Mo.—1,646,449.

Oil-Cracking Process and Apparatus. William C. Kirkpatrick, Alhambra, Calif., assignor to National Refining Process Corporation, Los Angeles, Calif.—1,646,543.

Process for Handling Crude Oil and Residuals. Albert E. Miller, Chicago, Ill., assignor to Sinclair Refining Company, Chicago, Ill.—1,646,760.

Cracking Still. Arthur A. Phelan, Los Angeles, Calif.—1,646,929.

Process for Destructive Distillation of Hydrocarbons. Charles Worth Turner, New York, N. Y.—1,647,026.

Method of and Apparatus for Lifting Oils. Gustav A. Kramer, Concord, Calif., assignor, by mesne assignments, to Simplex Refining Company, San Francisco, Calif.—1,647,367.

Treating Oil with Aluminum Chloride. Frank W. Hall, Port Arthur, Tex., assignor, by mesne assignments, to The Texas Company, New York, N. Y.—1,647,445.

Side-Furnace Oil Still. Robert A. Porterfield, Baltimore, Md., assignor to Prudential Oil Corporation, New York, N. Y. —1,647,664.

Combustion and Furnaces

Method of and Apparatus for Controlling the Combustion of Fuel in Furnaces. John William Griswold, Warren, Pa., assignor to Henry L. Doherty & Company, a Copartnership composed of Henry L. Doherty and Frank W. Frueauff, New York, N. Y.—1,644,123.

Electric Furnace. John A. Seede, Schenectady, N. Y., assignor to General Electric Company.—1,645,074.

Coke-Quenching Car. Albert H. Chalmers, Fairfield, Ala.—1,645,587.

Finely-Divided-Fuel-Burning Furnace. Henry Kreisinger, Piermont, N. Y., assignor to Combustion Engineering Corporation, New York, N. Y.—1,645,651.

Apparatus for the Manufacture of Carbonized Fuel. Stewart Roy Illingworth, Radyr, Wales, assignor to The Illingworth Carbonization Company, Limited, Manchester, England.—1,645,861.

Electric Furnace. Francis A. J. Fitz Gerald, Niagara Falls, N. Y., assignor to Harper Electric Furnace Corporation.—1,646,058.

Electric Furnace. John A. Seede, Schenectady, N. Y., assignor to General Electric Company.—1,646,221.

Organic Processes

Greenish-Yellow Azo Dyestuff and Process of Making Same. Hermann Wagner, Soden-on-the-Taunus, and Albert Funke, Hochst-on-the-Main, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,644,003.

Alcohol, Alcohol-Containing Mixtures, and Similar Liquids. Walter Ostwald, Bochum, Germany, assignor to Benzol-Verband Gesellschaft mit beschränkter Haftung, Bochum, Germany.—1,644,267.

Solution of Cellulose Esters. Joseph G. Davidson, Pittsburgh, Pa., assignor to Carbide and Carbon Chemicals Corporation.—1,644,417.

Reduction of Nitro Compounds. Ralph A. Nelson and Anton Prasil, Buffalo, N. Y., assignors to National Aniline & Chemical Company, Inc., New York, N. Y.—1,644,484.

Process of Decolorizing, Treating, and Dissolving Shellac for Bleaching Purposes. Frederick C. Rawolle, Salem, Conn.—1,644,491.

Manufacture of 2-Aminoanthraquinone. Donald G. Rogers, Buffalo, N. Y., assignor to National Aniline & Chemical Company, Inc., New York, N. Y.—1,644,494.

Acid Sulphuric Acid Ester Compound of Aromatic Hydroxyalkylethers. Winfrid Hentrich and Max Hardtmann, Wiesdorf, near Cologne-on-the-Rhine, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,644,524.

Manufacture of Isodibenzanthrones. Paul Nawiasky, Ludwigshafen-on-the-Rhine, and Otto Braunsdorf and Eduard Holzapfel, Hochst-on-the-Main, Germany, assignors, by mesne assignments, to Grasselli Dyestuff Corporation, New York, N. Y.—1,644,849.

Manufacture of Isodibenzanthrones. Heinrich Neresheimer, Ludwigshafen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,644,850.

Manufacture of Benzanthrone Derivatives Containing Sulphur. Heinrich Neresheimer, Ludwigshafen-on-the-Rhine, and Hans Emmer, Mannheim, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,644,851.

Fuel Composition. Samuel P. Marley, Pittsburgh, and William A. Gruse, Wilkinsburg, Pa., assignors to Gulf Refining Company, Pittsburgh, Pa.—1,645,109.

Process for Producing Benzoic Acid from Phthalic Anhydride. Courtney Conover, St. Louis, Mo., assignor to Monsanto Chemical Works, St. Louis, Mo.—1,645,180.

Production of Phenol-Methylene Resins and Alcohol from Methylals. Carnie B. Carter, Pittsburgh, Pa., assignor to S. Karpen & Bros., Chicago, Ill.—1,645,226.

Making Anhydrous Salts of Fatty Acids. Heinrich von Hochstetter, Konstanz, Germany, assignor to the Firm Holzverkohlungsindustrie Aktiengesellschaft, Konstanz, Germany.—1,645,265.

Manufacture of Tetra-Ethyl Lead. Herbert W. Daudt, Penns Grove, Alfred E. Parmelee, Carneys Point, and William S. Calcott, Penns Grove, N. J., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,645,375.

Oil Hardening with Nickel and Copper Formates. Carleton Ellis, Montclair, N. J. —1,645,377.

Production of a Tetra-Alkyl Lead. Kenneth P. Monroe, Penns Grove, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,645,389.

Process of Making Tetra-Alkyl Lead. Kenneth P. Monroe, Penns Grove, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,645,390.

Process for Dyeing Acidyl Celluloses. Paul Rabe, Leverkusen, near Cologne, and Wilhelm Schepss, Wiesdorf, near Cologne, Germany, assignors, by mesne assignments, to Grasselli Dyestuff Corporation, New York, N. Y.—1,645,450.

Process for Dyeing Acidyl Celluloses. Paul Rabe, Leverkusen, near Cologne-on-the-Rhine, and Wilhelm Schepss, Weisdorf, near Cologne-on-the-Rhine, Germany, assignors, by mesne assignments, to Grasselli Dyestuff Corporation, New York, N. Y.—1,645,451.

Process of Making Cellulose Esters of Organic Acids. Carl J. Malm, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y.—1,645,915.

Production of Fast Dyeings. Fritz Peterhauser, Riehen, near Basel, Switzerland, assignor to the Firm Durand & Huguenin S. A., Basel, Switzerland.—1,645,925.

Esters of Normal-Amyl Alcohol. Robert H. Van Schaack, Jr., Evanston, Ill.—1,646,128.

Process of Making Halogen Derivatives of Aromatic Organic Compounds. Joyce H. Crowell, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York, N. Y.—1,646,235.

Method of Treating Wax and the Products Resulting from Same. Otto E. Enell, Alhambra, Calif., assignor to Chadeloid Chemical Company, New York, N. Y.—1,646,280.

Process for Manufacturing 1-Aminonaphthalene-8-Carboxylic Acid. Richard Herz and Fritz Schulte, Frankfort-on-the-Main, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,646,290.

Fast Dyeing on the Fiber. Theodor Kircheisen, Dessau in Anhalt, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort, Germany.—1,646,296.

Process of Producing Sodamide. Justin F. Wait, New York, N. Y., assignor to National Aniline & Chemical Co., Inc.—1,646,372.

Thermal Decomposition of Hydrocarbons. George O. Curme, Jr., Charleston, W. Va., assignor to Carbide and Carbon Chemicals Corporation.—1,646,349.

Process of Producing Threads from Viscose. Charles A. Huttinger, Lakewood, Ohio, assignor, by mesne assignments, to The Acme Rayon Corporation, Cleveland, Ohio.—1,646,538.

Manufacture of Artificial Silk from Viscose. William Mendel, Beverly, N. J., assignor to Samuel A. Neidich, Edgewater Park, N. J.—1,646,625.

Glyoxal - Dianthraquinone Compound. Robert Berliner, Berthold Stein, and Willy Trautner, Elberfeld, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,646,782.

Aryl Esters of Nitro Amino Benzene Sulphonic Acids. Walter Duisberg, Leverkusen, near Cologne, and Winfrid Hentrich and Ludwig Zeh, Wiesdorf, near Cologne, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,646,785.

Manufacture of Artificial Silk. Emil Elsaesser and August Hartmann, Barmen-Langerfeld, Germany, assignors, by mesne assignments, to American Bemberg Corporation.—1,646,788.

Brown Substituted Benzidine Wool Dyestuffs. Wilhelm Neelmeier, Leverkusen, near Cologne-on-the-Rhine, Germany, assignor to Grasselli Dyestuff Corporation, New York, N. Y.—1,646,793.

Disazo Dye. James P. Penny, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York, N. Y.—1,647,145.

Dye Composition Containing Soluble-Cotton Yellow G. Henry Wenker, Hamburg, N. Y., assignor to National Aniline and Chemical Co., Inc., New York, N. Y.—1,647,162.

Liquid Fuel. Hermann Plauson and Peter Schröder, Hamburg, Germany, assignors to Lindon W. Bates, Mount Lebanon, N. Y.—1,647,471.

Process for the Manufacture of Organic Arsenic Compounds. Johannes Pfleger, Frankfort-on-the-Main, and August Albert, Munich, Germany.—1,647,662.

Painting Process and Composition Therefor. Allen Rogers, Brooklyn, N. Y.—1,647,666.

Process for the Production of Concentrated Acetic Acid. Ewald von Retze, Konstanz Baden, Germany, assignor to Holzverkohlungs-Industrie, A. G., Konstanz Baden, Germany.—1,647,676.

Inorganic Processes

Alumina Coagulant. Hugh McCurdy Spencer, Newark, N. J., assignor to Seydel Chemical Company.—1,643,962.

Carbon-Monoxide Detector. Chester S. Gordon, New York, N. Y., and James T. Lowe, Newark, N. J., assignors to American Telephone and Telegraph Company.—1,644,014.

Composition of Matter, a Superrefractory Body Formed Therefrom, and Process of Manufacturing the Same. Myer L. Freed, Washington, D. C., assignor, by mesne assignments, to Secretary of Commerce of the United States, as trustee for the Government of the United States and the People of the United States.—1,644,244.

Manufacture of Ferric Sulphate. Bertram Hart, Manchester, England.—1,644,250.

Process of Purifying Cadmium. Henry Howard, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,644,431.

Process and Apparatus for Utilizing Zeolites. Walter H. Green, Chicago, Ill., assignor, by mesne assignments, to General Zeolite Company, Chicago, Ill.—1,644,469.

Process of Roasting. John Burns Read, Golden, and Melville F. Coolbaugh, Denver, Colo., assignors to The Complex Ores Recoveries Company, Denver, Colo.—1,644,692.

Water-Softening Apparatus. Charles P. Eisenhauer, Dayton, Ohio, assignor to The Duro Company, Dayton, Ohio.—1,644,714.

Continuously-Operating Gas-Analyzing Apparatus. Olof Rodhe, Stockholm, Sweden, assignor to Svenska Aktiebolaget Mono, Stockholm, Sweden.—1,644,951.

Method of Producing High-Grade Vitreous Silica. Harold L. Watson, Lynn, Mass., assignor to General Electric Company.—1,645,080.

Method and Apparatus for Working Quartz. Edward R. Berry, Malden, and Philip K. Devers, Lynn, Mass., assignors to General Electric Company.—1,645,086.

Lead Cadmium Alloys. Walter Friedrich, Niederschoneweide, Germany, assignor to General Electric Company.—1,645,098.

Deaerating Water. George Herbert Gibson, Montclair, N. J., assignor to Cochrane Corporation, Philadelphia, Pa.—1,645,132.

Process of Solidifying Aluminum Chloride. Clifford W. Humphrey, Red Bank, N. J., and Donald S. McKittrick, Oakland, Calif., assignors to Clifford W. Humphrey, San Francisco, Calif., and Henry I. Lea, Santa Monica, Calif.—1,645,142.

Process of Purifying Aluminum Chloride. Clifford W. Humphrey, Red Bank, N. J., and Donald S. McKittrick, Oakland, Calif., assignors to said Humphrey and Henry I. Lea, Santa Monica, Calif.—1,645,143.

Chemical Engineering Equipment and Processes

Disintegrating Machine. Diedrich C. Addicks, Ragland, Ala.—1,643,938.

Power-Driven Conveyer. Arthur J. Hartley, Peoria, Ill.—1,643,986.

Treating Gaseous Mediums with Liquids. Edoardo Michele Salerni, Paris, France.—1,644,089.

Multistage Balanced Pump. Aladar Hollander, Berkeley, Calif., assignor to Byron Jackson Pump Mfg. Co., Berkeley, Calif.—1,644,129.

Process for Crystallizing Liquids. George T. Walker, Minneapolis, Minn.—1,644,161.

Automatic Weighing Machine. John Markman, Forreston, Ill.—1,644,260.

Process and Apparatus for Concentrating Active Deposit. Harry B. Palmer, Mendham, N. J.—1,644,350.

Method and Agent for Drying Gases. Wilhelm Müller, Butterfeld, Germany, assignor to the Firm I. G. Farben-Industrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,644,439.

Centrifugal Settling Machine. Frederick C. Rawolle, Salem, Conn.—1,644,492.

Method of Effecting Caustic Fusions. Donald G. Rogers, Buffalo, N. Y., assignor to National Aniline & Chemical Company, Inc., New York, N. Y.—1,644,493.

Sublimation Apparatus. Crosby Field, Yonkers, N. Y., assignor to National Aniline & Chemical Company, Inc.—1,644,518.

Specific-Gravity-Determining Apparatus. Garrett B. Linderman, Jr., Bethlehem, Pa., assignor, by mesne assignments, to American Meter Company, New York, N. Y.—1,644,684.

Hydraulic Conveyer. Frederic L. Ward, Detroit Mich.—1,644,699.

Packless Valve. Weston M. Fulton, Knoxville, Tenn., assignor, by mesne assignments, to The Fulton Sylphon Company, Knoxville, Tenn.—1,644,775.

Packless Valve. Weston M. Fulton, Knoxville, Tenn., assignor, by mesne assignments, to The Fulton Sylphon Company,, Knoxville, Tenn.—1,644,825.

Pulp Thickener. Edwin Letts Oliver, Oakland, Calif., assignor to Oliver Continuous Filter Company, Oakland, Calif.—1,644,854

Liquid Meter. Ralph N. Brodie, Oakland, and Albert J. Granberg, Berkeley, Calif.—1,644,868.

Combined Pressure and Float Actuated Switch. Ira E. McCabe, Chicago, Ill.—1,644,935.

Absorption Refrigerating Apparatus. Carl Georg Munters, Dala-Jarna, and Baltzar Carl von Platen, Ystad, Sweden, assignors, by mesne assignments, to Electrolux Serv-el Corporation.—1,645,017.

Rotary pump. Francis C. Peterson, Everett, Wash., assignor to Peterson & Nethaway,, Everett, Wash.—1,645,069.

Moisture Meter. Louis W. Thompson, Schenectady, N. Y., assignor to General Electric Company, a Corporation of New York.—1,645,077.

Art of Vulcanizing Caoutchouc. Clayton W. Bedford, Akron, Ohio, assignor to Goodyear Tire & Rubber Company, Akron, Ohio.—1,645,084.

Art of Gas Distribution. Robert G. Griswold, Westfield, N. J., assignor to Doherty Research Company, New York, N. Y.—1,645,137.

Working Fluid for Refrigeration. Andrew A. Kucher, Chester, Pa.—1,645,198.

Storage Tank for Gases and Volatile Liquids. John H. Wiggins, Bartlesville, Okla.—1,645,313.

Refrigerating Apparatus. Edward T. Williams, Brooklyn, N. Y.—1,645,314.

Screw Pump. Gilbert Rathman, Newark, N. J., assignor to William E. Quimby, Inc., New York, N. Y.—1,645,349.

Method of Drying Material. John E. Alexander, Port Edwards, Wis.—1,645,366.

Rotary Drier. David H. Couch, Warwick, R. I.—1,645,373.

Detecting, Indicating, and Recording the Presence of Inflammable Vapors or Gases. Henry Thomas Ringrose, Newark-on-Trent, England.—1,645,404.

Screen for Conveyers. Arthur L. Shaw, Chicago, Ill., assignor to Chicago Automatic Conveyor Co., Chicago, Ill.—1,645,405.

Condensing Apparatus. Fred G. Grell, San Antonio, Tex.—1,645,481.

Coconut-Shelling Machine. John F. Kohler, Larchmont Manor, N. Y.—1,645,600.

Velocity-Reducing Valve. Henry B. Lee, New London, Conn.—1,645,601.

Vibrating Screen. Benjamin A. Mitchell, Tompkinsville, N. Y.—1,645,613.

Agitator. Ormond B. Monahan, Des Moines, Iowa.—1,645,614.

Rotary Valve. Willibald Trinks, Pittsburgh, Pa., assignor to Homestead Valve Manufacturing Company, Homestead, Pa.—1,645,631.

Fluid-Feed Apparatus. John D. Brady, Bartlesville, Okla., assignor to Brady Process Company, El Dorado, Ark.—1,645,686.

Drier. Frank C. Chapman, Modesto, Calif.—1,645,738.

Process of Chilling and Aerating Fluids and Device for Carrying out Said Process. Thomas Arthur Fee, Jr., Vancouver, British Columbia, Canada, and Harry Lamb, Chicago, Ill.—1,645,742.

Drier or Dehydrating Plant. Frederick F. Knipschild, Oakland, Calif.—1,645,760.

Freezing Mechanism. Frank Tyson, Canton, Ohio.—1,645,782.

Apparatus for Unloading Compressors. William H. Callan, Cleveland, Ohio, assignor to Chicago Pneumatic Tool Company, New York, N. Y.—1,645,798.

Rotary Pump. Thomas S. Patterson, Malaga, N. J.—1,645,967.

Method of and Apparatus for Applying and Treating Varnish. George Richard Clover, Detroit, Mich., assignor to Cooper Hewitt Electric Company, Hoboken, N. J.—1,646,010.

Plug Valve. Fritz G. Cornell, Jr., Caldwell, N. J., assignor to W. H. Sheffield, New York, N. Y.—1,646,013.

Apparatus for Comminuting Materials. Charles H. Birch, Joliet, Ill.—1,646,184.

Tunnel Kiln. Paul A. Meehan, Cleveland, Ohio, assignor to American Dressler Tunnel Kilns, Inc., Cleveland, Ohio.—1,646,208.

Drier. William Stricker, Kansas City, Mo., assignor of one-half to Aaron Levingston, Kansas City, Mo.—1,646,223.

Apparatus for Ascertaining the Composition of Gaseous Mixtures. Hermann Heinicke, Seehof, near Teltow, Germany, assignor to Peter Jung, Neukölln, Germany.—1,646,247.

Tunnel Kiln. Paul A. Meehan, Cleveland, Ohio, assignor to American Dressler Tunnel Kilns, Inc., Cleveland, Ohio.—1,646,254.

Drier. Joseph Roberts, Edgewood, R. I., assignor, by mesne assignments, to Proctor & Schwartz, Inc., Philadelphia, Pa.—1,646,259.

Tunnel Kiln. Conrad Dressler, Cleveland, Ohio, assignor to American Dressler Tunnel Kilns, Inc., Cleveland, Ohio.—1,646,279.

Process for Resolving Water-In-Oil Emulsions. Eugene E. Ayres, Jr., Chester, Pa., assignor to The Sharples Specialty Company, Philadelphia, Pa.—1,646,339.

High-Speed Lobed-Impeller Blower. John T. Wilkin, Connersville, Ind., assignor to The Connersville Blower Company, Connersville, Ind.—1,646,373.

Method of Separating Two or More Substances from a Solution. Isak Isaachsen, Christiania, Norway, assignor, by mesne assignments, to A/S Krystal, Christiania, Norway.—1,646,454.

NEWS of the Industry

American Gas Association Meets at Chicago

FOR THE first time in several years the American Gas Association departed from its custom of holding its annual convention at Atlantic City and met in Chicago October 10 to 14. It was decided, however, that the 1928 convention should be held in Atlantic City at the usual time in October. Officers selected to direct the affairs of the Association during the coming year were: President, Oscar H. Fogg, Consolidated Gas Company, New York City; vice-president, B. J. Mullaney, Peoples Gas Light and Coke Company, Chicago; and treasurer, Clifford E. Paige, Brooklyn Union Gas Company, Brooklyn, N. Y. The officers of the Technical Section were re-elected to serve for another year, Walter C. Beckjord, American Light and Traction Company, as chairman, and Harry E. Bates, Peoples Gas Light and Coke Company, as vice-chairman.

Administrative reports of the officers showed that the past year had been notable for the absorption into the A.G.A. of the Natural Gas Association of America. This change has enlarged the field of work and increased the activities of the Association; it has also brought about a substantial increase in membership, including about 80 natural gas companies and over 1,100 individual members. The budget for the Association continues at approximately $450,000 per year, not including the large expenditures of the Central Laboratory at Cleveland or the industrial gas research program, each of which expends about $100,000 per year additional.

ONE OF the points of special chemical engineering interest in the general proceedings of the convention was the award to Frederick W. Sperr, Jr., of The Koppers Company, of the 1926 Beal Medal of the Association. This medal is awarded annually for the most valuable contribution to the advancement of the industry among the papers or addresses presented at the annual convention. The paper for which Mr. Sperr received his award was on the "Dehydration of Manufactured Gas" (see *Chem. & Met.*, February, 1927, pages 97-100).

The engineering interest at the convention centered around the investigations and report of the various committees which have been working on the Engineering and Economic Survey of the Gas Industry. This project and the other technical proceedings of the convention are reviewed in some detail elsewhere in this issue of *Chem. & Met.*

Commercial Aspects of Coal Hydrogenation

COMMERCIAL possibilities of coal hydrogenation in Germany, according to a translation of the remarks of Dr. C. Krauch, Director of the I. G. Farbenindustrie received by the Commerce Department, are as follows:

"Last fall, building was begun on a large experimental plant at the Leunawerke. This plant is partly in operation and the other part is to go into operation this year.

"To be able to correctly judge the question of the commercial possibilities of coal hydrogenation, one must inquire into possibilities for price fixing of comparative products, i.e. fuel recovered from crude oil, etc. Conditions obtain here so that production of high-boiling oils from crude oil far exceeds demand while production of gasoline is too small.

"Of course, thermal splitting of high-boiling oils into low-boiling oils has partly compensated for this condition, and this so-called cracking process has been much perfected. Crude oil prices in America have therefore declined by one-half in the past year as a result of over-production. Prices of refined products have not been lowered in the same degree by far.

KRAUCH states further, that the straight Bergius process has found no practical application as yet, so that it cannot be finally appraised. However, this process has been thoroughly worked out at an experimental plant in Rheinau.

With inauguration of its "oil from lignite" hydrogenation process for a yield of petroleum substitutes, the German Dye Trust is adequately secured in relation to this raw material. Present consumption by the I. G.'s Leunawerke, at Merseburg, is at the rate of from 7,000 to 8,000 tons of lignite daily for firing, and if three tons of this material is reckoned for each ton of oil to be produced, it is probable that next year's consumption will be increased by around 300,000 tons. It is supposed that the 1928 production of oil at the Leunawerke will not exceed 100,000 tons.

Agricultural Chemists Hold Annual Convention

THE forty-third annual convention of the Association of Official Agricultural Chemists was held at the Raleigh Hotel in Washington, Oct. 31-Nov. 2. There was an unusually good attendance of the people interested in such work. The official in charge of fertilizer control of nearly every state having any tonnage of fertilizer consumption was present—over twenty in all. Briefly the work of the general meeting covering the reports of the referees and papers presented was as follows:

The phosphoric acid referee found the official gravimetric method essentially satisfactory though certain precautions should be observed. The referee on nitrogen made a study of the methods for the determination of nitrate nitrogen in mixed fertilizers, recommending that the Jones method be adopted as a tentative method as its simplicity and accuracy made it most advisable. The referee on potash reported work on potash and chlorine determination but no conclusive data were yet available. Other highly technical papers were presented.

The presidential address by Dr. W. H. McIntyre of Tennessee gave a very clear description of the present methods of soil studies and pointed out many of the false theories that had been accepted for years but that had been exploded by research with better methods and equipment.

New Czechoslovak Nitrogen Plant Being Built

THE NITROGEN fixation plant at Moravska Ostrava, Moravia, is now under construction and is expected to be completed before the end of the year, according to assistant trade commissioner, K. L. Rankin at Prague. A series of tests are to be instituted after the plant is ready, however, and it is not anticipated that commercial production will begin before March, 1928. The initial capacity will be 15 metric tons of ammonia daily, which may later be increased to 25 metric tons. It is understood that the Claude method will be used. It is expected in Czechoslovakia that the plant will completely fill all domestic requirements and might even have a surplus available for export.

Symposia Planned for A.I.C.E. Meeting at St. Louis

THE TWENTIETH Annual Meeting of the American Institute of Chemical Engineers will be held at the Hotel Chase, St. Louis, Mo., Dec. 5-8. The meeting will open on Monday morning with a symposium on "Natural Gasoline" with R. T. Haslam as chairman. The papers will include "Oil Absorption of Natural Gasoline," by W. K. Lewis. "Natural Gasoline and Motor Fuels," by George Granger Brown. "Recoverable Hydrocarbons from Natural Gas and Their Relation to the Composition of Commercial Motor Fuel," by Stewart P. Coleman. "A Commercial Plant for Catalytic Oxidation of Oils," by J. H. James. "The Use of Chemical Reagents in the Protection of Atmospheric and Pressure Distillation Equipment Against Corrosion," by Gustav Egloff and Jacque C. Morrell.

In the afternoon motor buses will take the party to the smelter of the American Smelting and Refining Co. at Alton and to the Hoyt Metal Co. at Granite City. In the evening there will be a complimentary smoker with films showing the mining, milling and smelting of lead and the manufacture of white lead.

ON TUESDAY morning, Dec. 6, a joint session will be held with the American Refractories Institute with J. M. McKinley as the presiding officer. "The Story of Fire Clay Refractories" will be shown in motion pictures and speakers will include J. D. Ramsay on "The History and Status of the Refractories Industry"; Stuart M. Phelps on "Problems in the Development and Technology of Refractory Materials"; George A. Bole on "Some Special Refractories in the Experimental Stage"; and M. E. Holmes and George A. Bole on "Development in Burned Dolomite as a Stable Basic Refractory."

At luncheon an address will be given by George C. Smith, director of the Industrial Bureau of the Industrial Club of St. Louis. The joint session will then be continued with round table discussions of problems encountered by chemical engineers in the use of refractory materials. At five o'clock a council meeting will be held.

Wednesday, Dec. 7, will be devoted to all-day excursions to the lead mines in southwest Missouri of the St. Joseph Lead Company and National Lead Co., followed by a banquet in the evening. A business meeting will open on Thursday morning, Dec. 8, followed by a symposium on lead under the direction of G. W. Thompson. Speakers and their subjects will be as follows: "Characteristics of Very Pure and Commercial Lead," Geo. O. Hiers. "The Use of Lead in Sulphuric Acid Manufacture," A. E. Marshall. "The Use of Lead in Mechanical Engineering Practice," Owen W. Ellis. "The Use of Lead Compounds in Rubber Manufacture," J. R. Sheppard. "Synthetic Ammonia Costs in America," R. S. Tour. "The Absorptive Properties of Filter Aids," H. L. Olin, N. A. Skow and Louis Zapf.

The East St. Louis Light & Power Co. will tender a complimentary luncheon and in the afternoon visits will be paid to Laclede Christy Clay Products Company; Cakohia Power Plant; Union Electric Light & Power Company.

Chemical Societies Hold Joint Meeting

A JOINT meeting of the Society of Chemical Industry, Societé de Chemie Industrielle, American Chemical Society and American Electrochemical Society was held at the Chemists' Club, New York, on Nov. 4. About 200 members of the societies attended, first an informal dinner in the club dining rooms, after which the meeting assembled in Rumford Hall. A brief business session of the A.C.S. preceded the program of the evening. The first speaker, F. R. Wadleigh, consulting engineer, New York, presented a discussion of the "Preparation of Bituminous Coal; Its Scope and Significance to the User."

This was followed by an illustrated talk by Dr. H. J. Rose, of the Koppers Company, Pittsburgh, on the "Importance of Coal Preparation in the Manufacture of Gas and Coke." Dr. Rose stressed particularly the value of the proper subdivision and mixture of the coals used to insure production of coke with high mechanical strength.

Conference on Engineering Materials in Berlin

Special Correspondence

CHIEF ENGINEERING interest in Germany has been centered, October 22 to November 18, in the "Werkstoffschau" in Berlin, a conference on engineering materials embracing rather unique features as follows:—a very comprehensive exhibition, not only of steel and non-steel metallic engineering materials, but also demonstrations of the best and newest testing methods and testing machines, — physical, chemical, metallurgical, metallographical, and Roentgen Ray; the presentation in 40 different divisions of over 300 technical papers on engineering materials from the point of view of both the producer and the consumer. It is to be noticed with regret that in this so comprehensive exposition of engineering materials and pieces of testing apparatus those of American manufacture are notably lacking. On the other hand the American, who is accustomed to see in his own exhibitions of this nature an ostentatious and often obtrusive display of manufacturer's name and advertising matter, observes an absolute lack of such self-seeking. In fact, in most cases not even the name plates are on the machines, and if one desires the name of the manufacturer, he must seek it in the office of the director of the exhibition.

In general, it will be of interest to engineers to note that the Germans are quietly furthering their trade relationship with the great corporations of the United States, of which that of the General Electric Company with the I. E. G. is an example, and that, on the surface at least, these are functioning with mutual benefit to both nations.

That the Germans are well seized with the ideas of American scientific management and large scale corporations is manifest in the activities to be observed in many of the more aggressive and progressive plants that one has the fortune to visit.

McGraw-Hill Editor Wins Editorial Prize

A McGRAW-HILL publication captured the prize of $500 offered by the Associated Business Papers, Inc., for the best editorial written by a regular member of the staff of an A.B.P. publication during the year ended June 30, last. The winning editorial, which was announced at the annual convention of the Associated Business Papers, in the Drake Hotel, Chicago, was entitled "No More Panaceas," written by Sydney A. Hale and printed in *Coal Age*, July 15, 1926. Mr. Hale is associate editor of *Coal Age* and managing editor of *Coal Age News*.

International Newsreel Photo

Prohibition Chiefs and Alcohol Council Meets

Seated—George F. Dieterle, Dr. M. H. Ittner, Seymour Lowman, Dr. James, M. Doran, Russel R. Brown, H. S. Chatfield
Standing—S. C. Henry, H. E. Howe, C. M. Cline, A. H. Smith, A. Oftedal, F. M. Noonan, F. S. Rogers, Frank A. Blair

NEWS FROM WASHINGTON

By Paul Wooton

Washington Correspondent of Chem. & Met.

MEMBERS OF CONGRESS, assembling in Washington for the new session, are taking a much more hopeful view of the prospects for disposing of Muscle Shoals. This is the first indication of any development likely to break the impasse into which this legislation has headed previously.

While there can be no question that sentiment among farmers strongly favored large-scale fertilizer manufacture at Muscle Shoals, it has become generally understood that it would be impossible to put through such a plan and there has been also the realization that the development of the art of nitrogen fixation has made great progress since the Ford offer was made.

For these reasons the testimony of the Secretary of Agriculture before the Military Affairs Committee just prior to the close of the last session of Congress has had great weight. At that time Secretary Jardine suggested a separation of power development from the operation of the nitrate plants. The fact that he is convinced the existing facilities at Muscle Shoals for the manufacture of fertilizer could not compete with modern plants has influenced many of the farm leaders to accept his suggestion that the power be sold to the highest bidder and the proceeds used in efforts to improve the fertilizer situation.

SOME members of Congress are of the opinion that it would be best to build an experimental plant at Muscle Shoals in an effort to demonstrate the best methods of manufacturing concentrated fertilizers, but a more general opinion seems to be that private industry has nitrogen fixation well in hand. Production is increasing rapidly. Prices are trending lower and they are in doubt as to the need for the operation of a government-owned plant. They think the $2,500,000 which probably can be obtained for the power could be expended to greater advantage in research work on production problems and in demonstrating the practicability of the use of concentrated fertilizers.

Under this latter plan it is recognized that opposition will be reduced to a minimum. The plan can be made very productive to the farmer and the opposition from that quarter greatly reduced. It will please the power companies as the energy developed at Wilson Dam will go into distribution. It will please a wide area in the South anxious to have additional power made available. It will have strong support in Tennessee as it will make it possible for power development to go forward on the power reaches of the Tennessee River.

There will be no objection from the fertilizer manufacturers as the Department of Agriculture will make it clear that it is interested only in fundamental research and education in the use of fertilizers. The important opposition, therefore, will be reduced to the public ownership group and to the supporters of the use of all the power at or near the dam.

IT IS known that the Department of Agriculture has been planning a drive to popularize the use of concentrated fertilizers. If a considerable portion of the money which will be obtained from the power is made available for that purpose it is believed likely that a plan can be worked out for large-scale demonstration of what can be done with synthetic nitrogen and other fertilizer materials in concentrated form. The stumbling block in the past has been the difficulty in inducing the farmer to try a new form of fertilizer. With this money available it would be possible for the Department to work out a plan whereby the farmer could be guaranteed against loss in such an experiment. The thought is that concentrated fertilizers would be used over a large part of certain farms that would be selected in numerous communities. A small section of each field would be reserved for cultivation under old methods. If the results obtained with the new fertilizer should be less than those obtained by the methods which the farmer otherwise would have followed, the loss will be made up by the Government. In this way the Government will take the gamble rather than the farmer.

The difficulty presented by the construction of a new plant at Muscle Shoals is that it soon would become another white elephant on the hands of the Government. It is believed that commercial production can supply at reasonable prices all the raw material which is needed. This can be brought to the point of use through regular commercial channels and the many difficulties of distribution avoided which would arise were the Government to undertake manufacture.

In addition to the strong sentiment on Capitol Hill for disposing of Muscle Shoals it is fully expected that the President will make a strong recommendation to that effect in his message to Congress and that the administration will use its influence to further the Jardine plan.

IN FIXING 85,000,000 gallons as the maximum production of alcohol for 1928, the Industrial Advisory Council to the Commissioner of Prohibition is of the opinion that this will occasion no increase in prices. In fact, the opinion was expressed that prices are more likely to recede, particularly if the Cuban cane crop comes up to present estimates.

The Council was convinced that the working of the present permit system is satisfactory and that there has been considerable improvement during the past four months, although it is recognized that much work still is to be done along educational lines. The text of the order limiting the production of alcohol reads as follows:

"All applications for renewal of outstanding permits to operate industrial alcohol plants for the calendar year 1928 are required to be filed with the proper Prohibition administrators, and submitted by them to the Commissioner of Prohibition. When received by the Commissioner, he will indicate on each application his approval of the quantity of alcohol which may be produced in the industrial alcohol plant described therein during the ensuing calendar year and return the application to the administrator for the necessary action in connection with the issuance of renewal permits. Where renewal permits are issued by administrators pursuant to such applications, there shall be inserted in each such permit provision that the quantity of alcohol which may be manufactured thereunder shall not exceed the quantity approved in the application by the Commissioner, which amount shall be noted in the permit by the administrator.

"In any case where it appears, after operations have been conducted under a permit issued as above indicated, that correction of the quantity authorized to be manufactured is necessary in order to provide an adequate supply of alcohol or denatured alcohol for industrial purposes, the Commissioner may, upon proper showing of the facts, make such adjustment as he deems warranted in the quantity which may be produced under the permit during the calendar year."

IT IS not the intention of Commissioner Doran to call the entire Advisory Council each time questions arise. Many of the questions which will come up, he believes, can be handled by referring them to Dr. H. E. Howe, the secretary of the Council. He will lay the matter before the member of the Council familiar with the particular branch of industry involved, after which conclusions will be communicated to the other members of the trade for approval. In this way the entire Council will be assembled only when problems of general concern must be discussed. All members of the Council were present at the meeting, with the exception of Charles L. Reese, who is in Europe. Those in attendance were: Dr. Martin H. Ittner; Dr. Harrison E. Howe; H. S. Chatfield; A. Homer Smith; Frank A. Blair; Samuel C. Henry; Frank J. Noonan; Russell R. Brown; George F. Dieterle; C. Mahlon Kline; and Fred S. Rogers.

British Chemical Industry Works for Industrial Peace

Harmonious Relations Between Workmen and Employers Fostered By Generous Labor Program

From our London Correspondent

THERE ARE further signs of improving commercial conditions in this country and to a smaller extent in Europe generally. The coal trade is still a depressing feature and until this, and other basic industries, shows signs of real activity, progress in chemical industries is likely to be retarded. There are several other favorable influences at work, which may lead to some slight reduction in the burden of taxation when the details of next year's budget come up for discussion in the spring. Efforts toward further economies, the success of the Empire Marketing Board in influencing trade within the Empire and also the high level at which the sterling-dollar exchange now stands, are all likely to contribute. The latter feature is probably due in part to a change in the methods of finance due to the shifting of the center of gravity of gold resources and to diminished purchases of cotton and wheat.

The dominating factor during the next few years will undoubtedly be the educational and practical efforts which are made toward industrial peace and it is particularly refreshing to find that leaders of chemical industry are and always have been taking the lead in such matters. Messrs. Brunner, Mond & Co. have been without an industrial dispute for over fifty years and it is therefore only proper to refer to the comprehensive labor program built upon that firm's foundations by Imperial Chemical Industries. There is nothing strikingly new in the methods which were outlined by Sir Alfred Mond early this month, local, general and central works councils being proved methods of maintaining touch between the workers and the management. A works magazine is also an old stunt, but the real meat is in the system of promoting the hourly workers to the staff grade after five years, one month's notice of termination of employment and extended payments during holidays and sickness. The American system of endeavoring to make the worker a capitalist is also followed in a well considered manner and workers will be able to purchase the shares of Imperial Chemical Industries at favorable rates and in just proportion to their earnings and length of service, protection being also given by way of insurance against failure to pay instalments. Sir Alfred Mond probably hit the nail on the head when he said that our method of combatting socialism should be to make the poor rich instead of the rich poor, and it is only to be regretted that the late Roscoe Brunner did not live to see his pioneer work in labor problems translated into the excellent comprehensive scheme which has now been inaugurated. The recent retirement of Sir John Brunner was not unexpected and was due to personal reasons only.

THE HEAVY chemical industries of this country being largely concentrated in one group, it is becoming increasingly difficult to prevent these notes from becoming to a considerable extent a résumé of the activities and achievements of I.C.I. and its constituent companies. The same thing obtains in other countries, particularly Germany, but nevertheless, the individual inventor and the small enterprise still play a considerable part. Thus, it is still possible to raise money for an invention in this country, well knowing that the grant of a patent by no means signifies novelty or validity.

Without citing this as an example, reference may be made to English patent No. 225,953 of Dr. Robert Arnot, relating to the manufacture of a new type of glue to which the name "Yavan" has been given. This invention is based upon the discovery that under certain conditions, hide glue can be mixed with condensation products of the phenol formaldehyde type without risk of coagulation, provided that the glue is first hydrolized and protective colloids such as starches are present. The tanning action causing adhesion takes place under pressure and at a temperature of up to 100 deg. C. and remarkable results are said to have been obtained, not only with ply wood, but in obtaining proper adhesion of metal to ply wood, "celotex," etc. It is understood that arrangements have already been made for operation on a very large scale on the continent and that the British Empire rights are to be in the hands of an influential London syndicate. In about a month's time further information may be available, particularly in regard to the American rights, dealings in which are probably being held up pending issue of the corresponding patents.

Reference has been made to the negotiations for the chemical exploitation of the Dead Sea in Palestine: a premature announcement has appeared to the effect that Imperial Chemical Industries had been awarded the concessions and that the "Dead Sea Development Co., Ltd.," would be formed for this purpose and financed by I.C.I. without any financial appeal to the public. This is, as usual, a case of there being no smoke without fire and may have been a bait to extract the full facts. The chemical combine is not likely to be "drawn" and it will probably be some weeks yet before there is an authoritative announcement on this subject.

THE CHIEF sensation of the month has been the rise in the shares of British Celanese, Ltd., and this has enabled the company not only to rehabilitate its finances but to compose by means of a financial settlement, its outstanding difference with and its liability for royalties to the International Holding Co. The offer of twelve million dollars of $7\frac{1}{2}$ per cent mortgage bonds was oversubscribed, but enthusiasm for the shares themselves has since waned somewhat, possibly on realization of the fact that the company has never paid a dividend. If, as seems probable, the product itself may now have a successful future, the real question is whether the ultimate success will lie with the Celanese Co. or whether it will have to be shared with others who may be more competent technically or financially. At all events, the general impression is that the statements made in support of the share issue must be regarded to some extent as pious hopes and suitable allowances made for overweening enthusiasm and confidence. When the present turmoil dies down and if too much commercial stability is not sacrificed to further inventive effort, the prospects of this company, which has had such an unfortunate history, may be regarded as reasonably bright.

German-Norwegian Nitrogen Agreement Reached

THE NEGOTIATIONS which for the past year or so have been carried on between the Norsk Hydro and I. G. Farvenindustrie, Norwegian and German chemical companies, have been reported settled, say advices from Commercial Attaché H. Sorensen, Oslo. The two companies, according to the reported arrangement, will exchange shares so that each will hold an appreciable amount of shares of the other. This will be accompanied by an increase in capital by both the Norsk Hydro and the I. G. Farbenindustrie. A complete exchange of patents, methods and experimental information will also take place. The agreement is also said to include a sales combination.

For the Norwegian industry the agreement, it is expected, will immediately lead to the beginning of a complete modernization of the plants at Notodden and Rjukan, through which the present volume of production, 33,000 tons per year, will be greatly increased. It is the plan to discontinue the use of the Birkeland-Eyde arc process, and replace it by the German Haber-Bosch method. It is reported in Norway that the Norwegian output will be tripled by the new agreement and that Germany will benefit through the elimination of competition in markets where the trade is now allocated.

Franco-German Trade Accord Affects Customs Duties

French Import Tariffs on Chemicals Almost Doubled Under Schedules of the New Agreement

From Our Paris Correspondent

FAILURE TO stabilize the franc in keeping French industries in an unsettled position. Activity in many lines has slackened and this is especially true of the metallurgical and chemical industries. Export trade is still of good volume but home markets are steadily being contracted. Production costs as measured by prices for raw materials and by increased wage scales are working in favor of a curtailment of export buying and the situation may be further complicated if attempts are made to lower the compensation of workers.

Interest in the Franco-German trade agreement is combined with doubt regarding its practical working. Signed in Paris on August 17, the agreement was officially published in the "Journal Officiel" of August 31. The real agreement is, so to speak, headed by a decree giving all changes made in the old customs tariff. This altered tariff is the keystone of the treaty. It is in fact more or less the groundwork of a definite adequate tariff protecting the home products against German competition. This tariff has not been officially adopted as yet. A second decree was thus made necessary to bring into force the temporary working of the new provisions. It was issued on September 6. The agreement binds both parties until March 31, 1929, unless one of the contractors cancels the agreement before that date. Germany would have a very good opportunity for doing so if the French government taxes ammonium sulphate, a duty now suspended. A similar opportunity would arise if a new tariff in favor of natural nitrate of soda was issued, a thing that could bring great disturbances in the present run of business and cause serious damage to the manufacturers of products obtained by synthetic processes.

THESE reservations have just become known but they throw some light on the stratagems and threats which prevailed during the negotiations. Six lists are joined to the agreement, marked from A to F. The first four (A, B, C, D) apply to the German imported products in France and the remaining two (E and F) to the French exported products in Germany. The most interesting feature of the whole agreement is the granting "de jure" to Germany of the treatment of the most favored nation. Finally in a schedule, called "signature record," a commentary of paragraph 12 specifies that on August 15, 1928, the licensing clause mentioned in the decree of the London agreement of November 7, 1919, will come to end. This decree concerns all coloring matters, chemicals and pharmaceuticals imported into France by Germany in excess of the "payments in kind" anticipated by the peace treaty of Versailles.

The following table gives comparisons for the import duties prescribed by the former tariff, the tentative rates previously agreed upon, and the rates of the new Franco-German agreement, the figures being the minimum quotations per kilo:

	Old Tariff Rates Francs	Rates Previously Agreed Upon Francs	New Franco-German Agreement Francs
Oxalic acid	0.50	1.	0.20
Benzoic acid	5.76	11.75	7.50
Monoazoic colouring matters	4.80	16.	15.
Polyazoic colouring matters:			
Blacks	4.80	17.50	15.
Other colors	4.80	20.	15.
Diazotable reds fast to light	4.80	37.50	20.
Thioflavine	4.80	40.	20.
Sulphur colors:			
Black	7.20	14.	14.
Other colors	7.20	20.	15.
Colors derived from carbazol	7.20	22.50	15.
New methylene blue	7.20	32.*	20.
Vat colors:			
Derived from anthraquinone	9.60	75.	20.
Derived from sulphur anthraquinone	9.60	75.	20.
Thioindigo and colors derived from it	9.60	40.	20.
Synthetic indigo	7.20	17.	15.
Alizarine	7.20	23.	15.

According to these figures our chemical industries appear to be strongly protected. On an average the new tariff doubles the former tariff's quotations. It is for the French consumer to show whether he is willing to pay a premium for the German products resulting from the new custom duties. On the other hand it is up to the French manufacturers to increase their production from now to August 15, 1928.

Intersectional Meeting of A.C. S. at Maryland

THE MARYLAND Section of the A.C.S. will act as host to the Washington, Philadelphia, Virginia, Delaware and South Jersey Sections at an intersectional meeting to be held at the University of Maryland, College Park, Md., on November 26. At that time the university's newly erected Chemistry Building will be dedicated. The dedicatory exercises to which the public is invited will be held at 10:00 a.m. Dr. Edgar F. Smith of the University of Pennsylvania will be the principal speaker.

The afternoon session will be devoted to the intersectional program and at 6 o'clock there will be an informal dinner at which Dr. C. H. Herty will be the principal speaker.

Standards for Red Rosin Under Discussion

THE HEARING held Nov. 1 by the Food, Drug, and Insecticide Administration to consider the proposed new standards for rosin in which the predominating color is red, was attended by a complete representation of the producers and consumers of wood rosin. Among those present were C. F. Speh, secretary and manager of the Pine Institute of America, W. H. Crawford, chairman of the manufacturers committee, National Paint, Oil & Varnish Association, and L. R. Potter, of the Columbia Naval Stores Company.

The representatives of the producers of wood rosin, a product in which the red color predominates, presented their recommendations for the establishment of a single new standard applicable to the grading of wood rosin. They urged that the new standard be designated "F wood rosin," inasmuch as wood rosin was originally graded by the inspectors in the South as "F" because of its great clearness and brilliancy; and also because this designation and grading has been followed by the trade generally.

It was recognized, however, that the present Grade F, established by the Naval Stores Act, represents a color value quite different in kind and intensity from that of wood rosin. This led to an extended discussion of the possibility of confusion which might result from the adoption of the designation "F wood rosin." In the course of this free discussion, varying opinions were expressed and ideas developed which officials frankly admitted would be of value in the determination of this question.

Paper Is Ranking Industry of Newfoundland

THE EXTREMELY rapid growth of Newfoundland's pulp and paper industry has placed it first as a source of wealth to the Dominion, surpassing Newfoundland's fisheries which for generations have been acknowledged foremost, according to the Paper Division of the Department of Commerce. The value of Newfoundland's paper industry is now estimated to exceed that of the fisheries by about 20 per cent. Daily production of paper has increased from 200 tons to nearly 700 tons in two years, from 1924 to 1926. It is reported that a further increase to about 900 tons daily is expected in Newfoundland through pending developments.

Prussiate Production Sold for Next Year

At a recent stockholders' meeting of the British Cyanides Co., it was reported that agreements had been entered into whereby the whole of their output of prussiate of soda and red prussiate of potash had been disposed of until the end of 1928 at prices that should result in a better revenue than heretofore.

News in Brief

THE REGULAR fall meeting of the New York Section of the American Electrochemical Society will be held at Keen's Chop House, 72 West 36th Street, on Friday evening, Nov. 18. G. A. Anderegg, of the Bell Telephone Laboratories, will speak on submarine cable engineering.

CHILEAN VESSELS are to be given a bounty when carrying cargoes of Chilean nitrate of soda to foreign ports, a recent decree issued by the president of the Republic of Chile has proclaimed.

OIL LEASES covering 19,360 acres on the Osage Indian Reservation in Oklahoma will be offered at auction on December 6 at Pawhuska, the Department of the Interior announced on November 4.

ALREADY THREE GIFTS have been made to the Foundation of the Tanners' Council Laboratory including $5,000 given by Mrs. Louis Mayer, of East Orange, N. J., $500 given by George Raymond, chairman of the Board of Directors of Hans Rees' Sons, Inc., of New York, and $25,000 in its own 8 per cent preferred stock given by the Tanners' Products Co. in the name of Fred Vogel, Jr. Officers and directors of the Foundation are Ernest Griess, president; Percival E. Foerderer, vice-president; George W. Olmstead, treasurer; August H. Vogel, Elisha W. Cobb and Charles S. Walton, Jr., executive committee. Secretary will be J. L. Nelson, whose headquarters will be with the Tanners' Council in New York.

LARGE-SCALE USERS of gasoline, illuminating oils, fuel oils and lubricating oils and greases will be interested in the publication by the United States Bureau of Mines, Department of Commerce, of Technical Paper 323B, "United States Government Master Specification for Lubricants and Liquid Fuels and Methods for Sampling and Testing." This specification, the present revision of which was effective Oct. 21, 1927, was officially adopted by the Federal Specifications Board on Feb. 3, 1922, for the use of the departments and independent establishments of the Government in the purchase of materials covered by it.

THE BRITISH Carbo-Union, Ltd., London, England, recently organized, has taken over a number of companies engaged in carbon production, and will consolidate into a single organization. The new company will direct primary attention to the developing of use of active carbon for the recovery of solvents in air and gas mixtures. Plans are being projected for the erection of a new plant for the manufacture of active carbon for absorption and decolorizing purposes. The interests included in the merger comprise the I. G. Farenindustrie A.G., Leverkusen; Gesellschaft A.G., Frankfurt; Urbain Corporation, New York and Paris; and the Verein fur Chemische und Metallurgische Produkten, Karlsbad.

THE FIRST sugar mill to be established in South Dakota is now in operation at Belle Fourche, and the initial sack of beet sugar produced at the plant has been sold at public auction for one thousand dollars, as a souvenir symbolic of the possibilities in this branch of industry in the state. Nebraska and Colorado, neigboring states on the south, produce more than 100,000 tons and close to 400,000 tons of refined sugar, respectively, per annum, and these production figures are expected to be duplicated as the industry develops in South Dakota.

THE OLDBURY Electro-Chemical Co., Niagara Falls, N. Y., has acquired the local plant and business of the Phosphorus Compounds Co., and will consolidate with its organization. The plant will be continued in service as a unit of the purchasing company, specializing in the various derivatives of phosphorus, as heretofore.

THE DEPARTMENT of Chemistry, Massachusetts Institute of Technology, has adopted the use of motion pictures to supplement the regular work in lectures and laboratories. The pictures show various processes and industrial plants in operation. Up to the present time, the motion pictures have not replaced any of the regular work of the chemistry courses, but are used to amplify the technical information gained at the institution.

Conference on Bituminous Coal in November, 1928

OFFICIAL announcement comes from the Carnegie Institute of Technology in Pittsburgh that a second International Conference on Bituminous Coal will be held there during the week of Nov. 19, 1928. Decision to call a second congress of world scientists and fuel technologists has been made, it is announced, as a result of the widespread interest aroused throughout the world by the first Conference on Bituminous Coal held at the Carnegie Institute of Technology in November, 1926.

The first conference, which was devoted to discussions of the better utilization of bituminous coal, was attended by 1,700 persons, including delegates from thirteen different countries. Although no definite program plans for the second conference have been made, it is expected that the 1928 session will cover the latest developments in obtaining substitutes for gasoline from coal, power from coal, low and high temperature distillation processes, smokeless fuel, gasification of coal, utilization of coal tar products, coal as a source for fertilizer, and coal in relation to the production of fixed notrogen.

Members of Chemists' Club Hold Housewarming

CELEBRATING "the transmutation of the club from tenant to landlord," more than a hundred members of the Chemists' Club of New York attended the "housewarming" on the evening of Oct. 26. An informal dinner served in the spacious lounge, was followed by a mélange of reminiscences, current discussion and speculations as to the future of this organization which has done so much to promote the social unity of American chemists.

As a result of the contribution of their holdings in the Chemists' Building by various members, the club finds itself owner of a substantial majority of the stock. T. B. Wagner, president of the Chemists' Club, traced the developments which led up to this consummation and expressed appreciation of the generosity of those members who made it possible.

W. Jay Schieffelin, president of the Druggists' Supply Co., of New York, recalled in an intimate and amusing manner the conception of the Chemists' Club, the striking personalities whose influences have shaped its development, and the active part the club has played in American chemistry during the last quarter century.

Visioning a future of increased usefulness for the Chemists' Club, L. V. Redman, vice-president of the Bakelite Corporation, pointed out the probability of greatly increased valuation of the present building which would make possible the acquisition of new and better quarters when they are needed.

Ralph E. Dorland, of the Dow Chemical Co., spoke humorously of the relationship between the technical man and the salesman, adding that the Chemists' Club has done much to "humanize" the chemist.

Congratulatory messages were received from leading technical and scientific associations throughout this country and abroad.

Leather Industry Seeks Standardization

IMPROVED methods of removing hides and standardization of leather are sought by members of the leather industry working through the Tanners' Council, and assisted by the Hides and Leather Division and the Division of Simplified Practice of the Department of Commerce and by the Department of Agriculture. The Hides and Leather Division and the Simplified Practice Division are co-operating with the Tanners' Council in enlisting the interest of the leather industry in the standardization of leather. They will probably consider among other things the matters of color, weight and thickness of leather. Simplification could also establish standard specifications of leather so that Light Medium and Heavy Medium, or whatever designations are decided upon, will have a common meaning.

MEN *you should know about*

Irving Langmuir, assistant director of research, General Electric Company, has been selected to receive the Perkin Medal for 1928.

Robert T. Haslam of the Department of Chemical Engineering resigned from the Institute faculty, effective November 1. For some time past Professor Haslam has acted as a technical consultant and advisor on research and development projects for the Standard Oil Company (New Jersey) and its affiliated companies, giving to this work an increasing proportion of his time. He will continue his connection with the Institute as non-resident professor of fuel and gas engineering but will devote practically his entire time to development work relating to the oil industry as a member of the executive staff of the Standard Oil Development Company at 26 Broadway, New York City.

Edwin H. Lundgron has been elected vice-president and general sales manager of the Combustion Engineering Corporation, New York.

H. W. Brooks has resigned as consulting engineer for the Erie City Iron Works, Erie, Pa., to re-engage in private consulting practice with offices in New York and St. Louis. His residence address remains as before, 1300 McPherson Blvd., Fremont, Ohio. Mr. Brooks is known for his research and development work in low temperature carbonization, pulverized fuel and steam power plant engineering. He was formerly fuel engineer for the U. S. Bureau of Mines and during the war, Chief of the Machinery Section, Bureau of Ordnance, U. S. Navy.

H. N. Spicer of the Dorr Company, New York, accompanied by Mrs. Spicer, has left for Australia, China and Japan, to be gone for several months, in connection with his company's interest in those countries.

Andrew E. Buchanan, Jr., who served as assistant editor of *Chem. & Met.* in 1922-23, and who since that time has been connected with Lehigh University, returned to the editorial staff of *Chem. & Met.* Mr. Buchanan was formerly engaged in chemical production work with the duPont company.

Martin H. Ittner, chief chemist of Colgate and Co., Jersey City, N. J., has been appointed chairman of the industrial alcohol council recently formed by Assistant Secretary Lowman of the United States Treasury Department.

Harold R. Harper, formerly a member of the research staff of the Eagle Picher Lead Co., Chicago, Ill., has become assistant to J. H. Calbeck, Joplin, Mo. at the local Calbeck Laboratories.

William Richter is now general manager of the paint, lacquer and chemical department of E. I. duPont de Nemours & Company, Inc. In this position he succeeded William P. Allen, who was relieved at his own request for a year's leave of absence effective November 1. Mr. Richter's experience

WILLIAM RICHTER

with the paint and varnish business began with his association with Harrison Brothers in 1905. Later he served as comptroller for the duPont Engineering Company. Before becoming assistant general manager of the department he now heads, Mr. Richter was divisional manager in Philadelphia of the acids, heavy chemical and pigment division.

David Wesson, chemist, chemical engineer and technical counsellor of the Southern Cotton Oil Company has removed his office to 111 South Mountain Avenue, Montclair, N. J.

General John J. Carty will be awarded the John Fritz gold medal for 1928 for achievement in telephone engineering. The presentation will take place in New York, February, 1928.

L. C. Cooley has joined the staff of the Swenson Evaporator Company, Harvey, Ill., a subsidiary of the Whiting Corp., in the capacity of chemical engineer. In addition to research work Mr. Cooley has had over ten years field experience, including the installation and operation of evaporators, filters and related process equipment.

Dalton M. Goetschius, who has been employed as chemical engineer in charge of research and development for the Radium Dial Company of Pittsburgh, has been appointed assistant to that company's vice-president, R. G. Fordyce, of Chicago. Mr. Goetschius' headquarters have been shifted to the main plant at Ottawa, Illinois, where he has assumed the duties of resident manager and technical director.

W. A. Forbes, assistant to the president of the United States Steel Corporation presented a paper before the American Iron and Steel Institute, October 28, on "Technological Problems of the Steel Industry."

Graham L. Montgomery, assistant editor of *Chem. & Met.* since March, 1922, has joined the editorial staff of *Power*, another of the McGraw-Hill publications. In his new connection Mr. Montgomery will continue his interest in process steam, material handling and the other industrial applications of power.

John D. Grothe, technical director of the Societe-Dorr et Cie of Paris, arrived in New York on October 18. He will spend several months studying the progress made in engineering since his last visit to this country five years ago.

Sir John Brunner has resigned from the directorate of the Imperial Chemical Industries, London.

B. Ullstrand, chief chemist for The Brown Company, Portland, Me., pulp and paper products, for the past four years, has resigned to accept a similar position with the Marma Company, Soderhamm, Sweden.

Robert N. Wenzel of Palo Alto, Calif., previously connected with the research divisions of the Monsanto Chemical Works, St. Louis, Mo. and the American Smelting & Refining Company, New York, is the recipient of a fellowship in tallow and greases at the Mellon Institute of Industrial Research, Pittsburgh, Pa., established by the Emery Candle Company, Cincinnati, Ohio.

Harold H. Parker has been made a research chemist at the plant of the duPont Rayon Company, Old Hickory, Tenn.

John S. Boyce has been appointed director of the Northeastern Forest Experiment Station, Amherst, Mass.

J. E. Underwood, formerly of the chemical staff of the National Lime Association and more recently consulting and research chemist for the Rockland and Rockport Lime Corporation, is now in charge of research work for the Pennsylvania Salt Manufacturing Co. located at the Greenwich works in Philadelphia.

C. G. Dunkle, formerly with the Pittsburgh Experiment Station of the Bureau of Mines, is now assistant chemist of the Sanitary Water Board, Pennsylvania Department of Health, Harrisburg.

Charles B. Karns, chief chemist and superintendent of the Galena Signal Oil Company, Franklin, Pa., has resigned to become chief chemist for the Pennsylvania Lubricating Co., Pittsburgh, Pa.

Ross C. Purdy, secretary of the American Ceramic Society, has returned from a six-weeks' trip abroad, where he has been perfecting arrangement for the proposed European tour of members of the society next spring.

OBITUARY

J. M. Camp

James McIntyre Camp, director of the bureau of technical instruction of Carnegie Steel Company, Pittsburgh, Pennsylvania, died at his home in that city October 24, following a few days illness from pneumonia.

Mr. Camp was born November 12, 1859 in the city of Allegheny, now N. S. Pittsburgh, and was graduated as a civil engineer from the University of Western Pennsylvania, now the University of Pittsburgh, and in 1882 became assistant chemist of the Pittsburgh Steel Casting Company. Later he returned to the same school for a two-year course in inorganic chemistry, and in 1889 was made chief chemist of the Allegheny Bessemer Steel Company, which subsequently became the Duquesne works of Carnegie Steel Company. In 1907 he was appointed chairman of the Chemists' Committee of the United States Steel Corporation, in which office he directed the work of the chemists of the various subsidiary companies of this corporation in devising, proving, and standardizing the methods of sampling and analyzing iron and steel works materials, which are issued in printed form and made available to the public. In 1911 he was transferred to the Pittsburgh offices of Carnegie Steel Company and directed the various educational activities of this company.

In his career as a chemist, Mr. Camp was an energetic and progressive director and student, and in his laboratory at Duquesne many new and rapid methods of great value to the iron and steel analytical chemists were devised. With Francis C. Phillips and others, he formed the chemical section of the Engineers Society of Western Pennsylvania, which later became the Pittsburgh Section of the American Chemical Society. At the time of his death he was also a member of the Iron and Steel Institute (British), the American Iron and Steel Institute, and the American Society for Steel Treating. At intervals from 1882 to 1921, he presented valuable papers before some of these societies. With C. B. Francis, he was also co-author of the Making, Shaping and Treating of Steel, which is not only widely used as a text book, but is also recognized as an authoritative work by those engaged in the field of steel manufacture.

J. Jarvis Preble, vice-president of the Spray Engineering Company, died October 20.

Norman Spear Lawrence, vice-president and director of sales of the Whiting Corporation, Harvey, Ill., died October 26 after a brief attack of pneumonia. Mr. Lawrence was born May 9, 1882, at Chicago, Ill., and was educated in the schools of Chicago. He graduated from Cornell University in the class of '04 as a mechanical engineer, and shortly after entered the employ of Whiting Corporation as an estimator, becoming successively chief estimator, assistant sales manager, vice-president and director of sales. During the past few years Mr. Lawrence was also president of the Swenson Evaporator Company, a subsidiary of Whiting Corporation.

James Baille of the American Lanolin Corporation, Lawrence, Mass., died Oct. 18.

John I. Mullen, engineer and research man for the Standard Chemical Company for 20 years, died October 25.

Harry L. Brown, secretary of the Ohio Brass Co. and formerly editor of the *Electric Railway Journal*, a McGraw-Hill publication, died October 23, at Toledo, Ohio.

James McIntyre Camp

Edward J. Fowler, president and general manager of the Pacific Foundry Co., San Francisco, died October 18 in that city after a brief illness. Mr. Fowler was formerly metallurgist for the Union Iron Works until 1904 when he established the Pacific Foundry Company. He was an important factor in the metallurgical industry on the Pacific Coast and made a number of contributions to it progress.

Milton Whitney, who was chief of the Bureau of Soils of the Department of Agriculture from 1894 until June of this year, died at his home in Takoma Park, Maryland, on November 11 after an illness of many months' duration. Dr. Whitney was born in Baltimore August 2, 1860. He had spent his entire professional career in the field of agricultural chemistry experimentation, being first connected with the Connecticut Agricultural Experiment Station and later, in succession, superintendent of the North Carolina experimental farm, director of South Carolina Experiment Station, and soil physicist of the Maryland Experimental Station. Subsequent to Dr. Whitney's retirement the work of the Bureau of Soils was reorganized in consolidation with the Fixed Nitrogen Research Laboratory and other research activities of the Department. Under this reorganization the work which Dr. Whitney had directed is now divided between the division of fertilizers, directed by F. G. Cottrell and the division of soils, under A. G. McCall.

CALENDAR

American Ceramic Society, tour through France, Germany, Czechoslovakia and England, May 19-July 16, 1928.

American Chemical Society, spring meeting St. Louis, Mo., April 16-20, 1928.

American Construction Council, 6th annual convention, St. Louis, Mo., Dec. 1-3.

American Institute of Chemical Engineers, St. Louis, Mo., Dec. 5-8.

National Exposition of Power & Mechanical Engineering, New York, Dec. 5-10.

National Symposium of General Organic Chemistry (second) Ohio State University, Columbus, Ohio, Dec. 29-31.

INDUSTRIAL NOTES

The U. S. Stoneware Company of Akron, Ohio, has acquired the plant formerly occupied by the Acid Proof Clay Products Company, at Tallmadge, Ohio, which will be known as Plant No. 3. It is planned to overhaul the new Tallmadge works and to install considerable new machinery and equipment designed to allow for more economical production. It is expected that the new plant will be running at capacity production at the end of this month.

The Walworth Company, Boston, Mass., announces the appointment of the James E. Degan Company of Detroit, Michigan, as distributors of a complete line of iron, brass and steel Walworth valves.

The American-LaFrance Fire Engineering Company, Inc., of Elmira, N. Y., has acquired the assets and good will of the Foamite-Childs Corporation, of Utica, N. Y., and the business of the two companies will be combined under a single corporate identity, known as the American-LaFrance and Foamite Corporation.

The Morse Chain Company announces the appointment of Harry E. Matthews as manager of its Charlotte, N. C., office, to succeed George W. Pritchett, who died in September. Mr. Matthews has been assistant manager of the Charlotte office for the last eight years.

The Brown Instrument Company announces the opening of a Kansas City branch at 509 Mutual Building, with F. M. Poole as district manager.

The Philadelphia Quartz Company, in order to regain its former position in the Chicago market with the least amount of unfavorable effect on the industry, has arranged for the outright purchase of that portion of the business of the Central Commercial Company of Chicago which is devoted to the production and sale of silicates of soda.

The Chicago Pneumatic Tool Company, New York, announces the removal of its Cleveland District Sales office to 1727 Union Trust Building.

The Jeffrey Manufacturing Company, Columbus, Ohio, have elected Robert W. Gillispie as vice-president and general manager.

The Rollway Bearing Company, Inc., Syracuse, N. Y., has appointed R. D. Faris its Cleveland district representative.

The Lincoln Electric Company, Cleveland, Ohio, announces the appointment of E. A. Thornwell of Atlanta, Ga., as its representative for Georgia and Eastern Tennessee. John Van Horn is to assist Mr. Thornwell.

The Foote Bros. Gear & Machine Company, Chicago, Ill., has purchased the A. Plamondon Mfg. Company of Chicago.

The Erie City Iron Works, Erie, Pa., announces the following appointments: J. R. Edwards as manager of sales; J. R. LeVally as special representative; Joel Ecklund as a sales engineer and C. O. Hoban as special representative, all at Erie, Pa., and C. A. Reed as Pittsburgh district manager.

MARKET CONDITIONS and PRICE TRENDS

European Chemical Manufacturers in Combination

Export trade in chemicals and allied products is threatened by the greater competition which is ex- expected to arise as a result of the agreement among German, French, and British producers.

FAR REACHING significance is attributed to the announcement which was made last month relative to the consummation of an agreement between French and German producers of chemicals. This information first came in the form of a cable from R. C. Miller, acting commercial attaché at Paris. It stated that an agreement had been reached between the leading French and German chemical producers covering the sale of dyestuffs and nitrogenous fertilizers. While there are certain final details which have yet to be arranged, it seems to be the general opinion that the accord was practically ready for the signatures of the officials of the I. G. Farbenindustrie, A. E., Germany's leading chemical producer, and the recently formed French Central Committee.

The agreement fixes the selling prices on dyestuffs and establishes a quota for French imports of German dyestuffs. It also provides for a division of the foreign markets with the object of reducing competition throughout Europe and other countries.

France agrees to restrict her exports of nitrogenous fertilizers to the 1926 level and to purchase any necessary imports primarily from Germany. The fertilizer agreement, however, hinges upon the acceptance by the French Parliament of the recent Franco-German treaty which admits German nitrates free of duty; or upon the establishment of merely negligible duties on such importations.

The cable also stated that Franco-German negotiations are progressing with respect to a rayon accord. Although there are other reports which state that rayon producers are not working together harmoniously and that a new factor may enter the rayon field.

It is reported in trade and other circles that negotiations between the French interests and the British chemical combine—the Imperial Chemical Industries, Ltd., have practically been concluded covering the trade in rayon and dyestuffs.

IN ADDITION it was stated that negotiations leading to a European synthetic nitrogen entente are progressing favorably and present plans include in the association German, French and British producers, also those in Norway, Italy and Switzerland. It is stated that the purpose of the entente is to better enable the individual producers to meet the stronger competition of Chilean nitrates which they expect as a result of the plans of Chilean producers to co-ordinate sales on the European market. European producers are looking forward to lower prices of Chilean nitrate of soda as a result of improved methods of treating the crude mineral. The German and the Norwegian synthetic nitrogen producers have come to an agreement similar in scope to that of the Franco-German potash accord. It is rumored in business circles that a more far reaching international nitrogen entente has been proposed which would include the Chilean producers with the major European synthetic producers and would divide the world's nitrogen markets, fix prices, regulate sales and production.

MANUFACTURE of chemicals in the United States has made rapid strides since 1914. Importations still run to large volume but by far the greater part of requirements are supplied by domestic producers. During war years plant capacities were extended to take care of the unusual consuming demands. Since then it has been the problem of manufacturers to develop trade to a point where the war-time standard of output might be sustained. To make this possible it was necessary to broaden outlets in foreign markets so as to dispose of surplus production outside this country. Even with an increased export trade, productive capacity in many branches of the industry was in excess of possible distribution and it has been necessary to regulate production in order to maintain a proper balance between supply and demand. The normal growth of the country provides for a more or less proportionate increment in domestic consumption of chemicals and this business does not appear to be in danger because of the working agreement just entered into by European manufacturers. Where producing costs here and abroad are not on a parity the protection of tariff imposts may be invoked.

THE fact that development of the American chemical industry is dependent on an outside outlet for surplus production makes it a matter of moment when anything arises which might cut down the volume of chemicals to be exported. The entente now existing among chemical manufacturers in Europe, to say the least, is not regarded as favoring our export business. In addition to the benefits to be derived from a centralization of sales efforts with probable lowering of distribution as well as producing costs, it is almost inevitable that competition for business in foreign trade will be increased and the price advantage should rest with European sellers.

In recent years export trade in chemicals with South America has been growing. In 1926 shipments to those countries were valued at $20,543,000 with the Argentine as the leading buyer. Trade with Mexico, Central America, and contiguous islands also has been on an upward scale. The Far East has been one of the largest buyers of certain American-made chemicals. Even Europe has offered fertile fields for domestic sellers. Just how far this foreign trade is to be disturbed by the changed conditions abroad remains to be seen. It is regarded as certain, however, that domestic sellers will find it increasingly difficult to increase business with foreign countries if not to maintain anything like the present volume.

OUTSIDE of the recent combination, Germany has been forming agreements either national or international with a view toward lessening competition and increasing sales of chemicals. For instance it has just been reported that about ten German and Netherland firms producing sodium silicate led by Persilfabrik Hendel & Co., of Duesseldorf, have joined forces to export their production against foreign competition led by Great Britain, France, Spain, Italy, Finland, and Rumania. The combination is known as "Wasserglasverkaufsstelle" Duesseldorf. Its agreement runs for an indefinite period.

Domestic sales by German concerns remain free in open competition, while exports are regulated according to a quota-scale, depending upon the capacity of the associated concern.

MARKET CONDITIONS *and* PRICE TRENDS

Production of Chemicals Falls Below Last Year's Standards

PRODUCTION OF chemicals has shown some expansion in the last month and in some cases is reported as active. The rate of output compares favorably with the average for preceding years but suffers in comparison with the unusually active period of a year ago. Throughout 1926 chemical production was maintained at a high level and the last quarter of the year was decidedly favorable for all branches of the industry. That condition continued through the early part of 1927 but was followed by a quieter period. The customary slowing up during the hot weather months has been succeeded by an enlargement of operations but neither production nor consumption of chemicals has attained the levels reached at the corresponding period of last year. General business reported improvement in October as compared with September but not sufficiently to place it on an equal footing with October, 1926. In the south material gains in productive activities were reported last month and to a lesser degree this held true of western states. New England, however, still reports relatively quiet conditions.

THE position of industries which afford large outlets for chemicals may be inferred by reference to employment conditions which prevailed. The latest figures on employment refer to September and show that, with scarcely an exception, manufacturing production was running below that for the corresponding period of last year. The Bureau of Labor compilation gives weighted indexes of employment as follows:

Indexes of Employment

	Sept., 1927	Aug., 1927	Sept., 1926
Dyeing and finishing textiles	98.3	96.5	96.0
Leather	89.2	88.6	92.3
Paper and pulp	93.3	93.2	95.9
Chemicals	95.3	93.3	95.9
Fertilisers	95.2	71.7	108.6
Petroleum refining	91.1	93.5	102.7
Glass	92.5	89.4	100.5
Automobile tires	106.7	110.4	114.9
All manufacturing	88.0	87.4	92.2

Reports of smaller productions in September this year also are borne out by production statistics which are available. For instance the output of chemical pulp for that month was put at 210,038 tons as compared with 218,466 tons in September, 1926. In view of reports of overproduction of pulp and paper, the outlook does not favor an increased call for chemicals from that direction in the near future. Production of explosives in September was 36,858,000 lb. which again suffers in comparison with the September, 1926 output of 40,741,000 lb. Production of refined methanol was 441,771 gal. and 700,211 gal. respectively in September, 1927, and September, 1926. Producers of acid phosphate, on the other hand, have been more active and report 267,516 tons for September as against 243,599 tons in the corresponding month of last year. In fact, the fertilizer industry as a whole has started the fiscal year in an encouraging manner, tag sales for Aug.-Oct. inclusive representing a gain of 10 per cent over those of a year ago.

PRODUCTION of raw materials in September, as seen from the weighted index of the Department of Commerce, was greater than in September of last year, increases in the marketings of crops and the production of forest products being more than sufficient to offset declines in the output of minerals and in the marketings of animal products. The output of manufactures, after adjustment for differences in working time, showed no change from the preceding month but was lower than in September of last year.

The unadjusted figures showed increases over the preceding month in the output of nonferrous metals and in the production of chemicals and oils, all other industrial groups either declining or showing no change. As compared with last year, increased output was registered in foodstuffs, textiles, leather products, chemicals and oils, stone, clay and glass products and tobacco, all other groups declining.

Stocks of commodities, after adjustment for seasonal variations, were lower at the end of September than at the end of the previous month, but higher than a year ago. As compared with the preceding month, commodity stocks showed declines in the holdings of raw and manufactured foodstuffs, stocks of other manufactured commodities and raw materials for manufacture showing increases. As compared with last year, all groups showed increased stocks.

The unfilled order index, covering principally iron and steel and building materials, reached a new low point in September, both major groups being lower at the end of that month than at the end of either the previous month or a year ago.

Decline in Imports of Synthetic Dyes

Germany continues as the principal foreign shipper of synthetic dyes to this country with Switzerland holding second place. Imports in October showed a decline as compared with the total for October, 1926. Imports for the ten months ended October were as follows:

	1927 Lb.	1926 Lb.
Jan.	196,620	300,441
Feb.	312,277	369,045
March	404,714	487,804
April	402,783	437,526
May	349,476	392,739
June	318,450	333,319
July	263,162	351,425
Aug.	401,122	380,414
Sept.	396,432	387,533
Oct.	417,626	460,351
	3,462,662	3,900,597

PRICES for chemicals have shown no decided movement in either direction but have been featured by a lower schedule for 1928 deliveries in the case of some important selections. The weighted index number for chemicals now stands at 112.02 as compared with 112.37 a month ago and 114.13 in November, 1926.

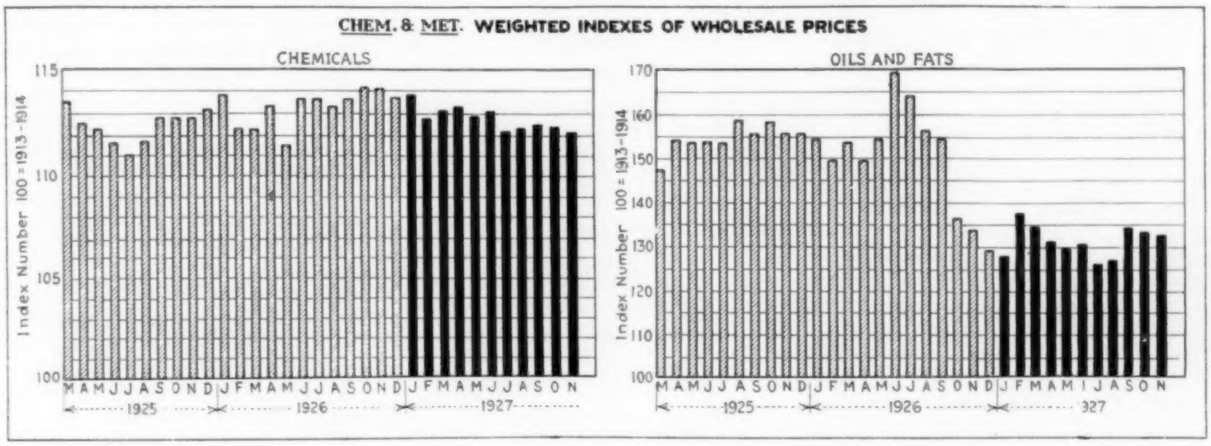
The trend of values in the market for vegetable oils and fats has been downward. Crude cottonseed oil has developed an easier tone and linseed oil was low in price throughout the month although the market now shows a tendency to stiffen. The weighted index number for oils and fats is 132.90 compared with 133.77 last month and 133.76 last year.

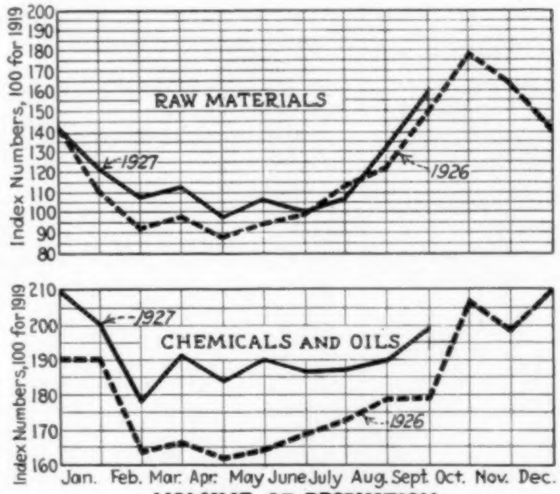
Exports of chemicals and allied products from the United States during the first three quarters of 1927 advanced 9 per cent in value, from $132,428,000 in the first three quarters of 1926 to $145,000,000 in the 1927 period. Improvements occurred in all of the major groups with the exception of fertilizers and explosives. Notable decreases in the prices of rosin and turpentine kept the aggregate value of the naval-stores group at about the same figure as in 1926, while quantities were much higher. In the coal-tar products group, exports of benzol and other crudes were much larger than in 1926, and in the fertilizer category, phosphate-rock shipments showed a tendency toward recovery, with much better demand from the larger European markets, especially England and Germany.

The soda group also showed a better demand from foreign markets with a 13 per cent gain to $7,000,000 (283,000,000 pounds) for the period. Larger amounts of sodium chromate and bichromate, of borax, soda ash, sodium silicate, and sal soda were sent abroad.

CHEM. & MET. STATISTICS OF BUSINESS

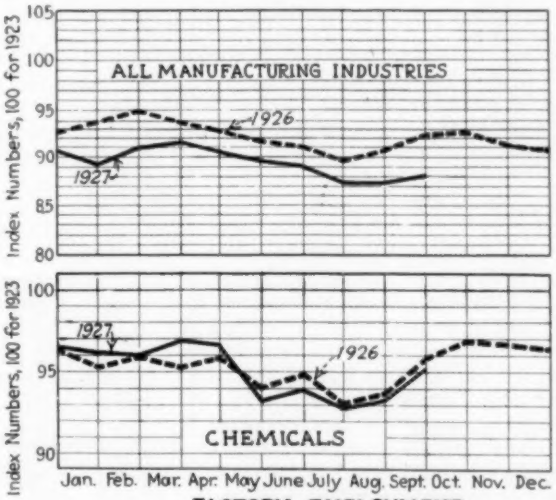
IN THE CHEMICAL ENGINEERING INDUSTRIES





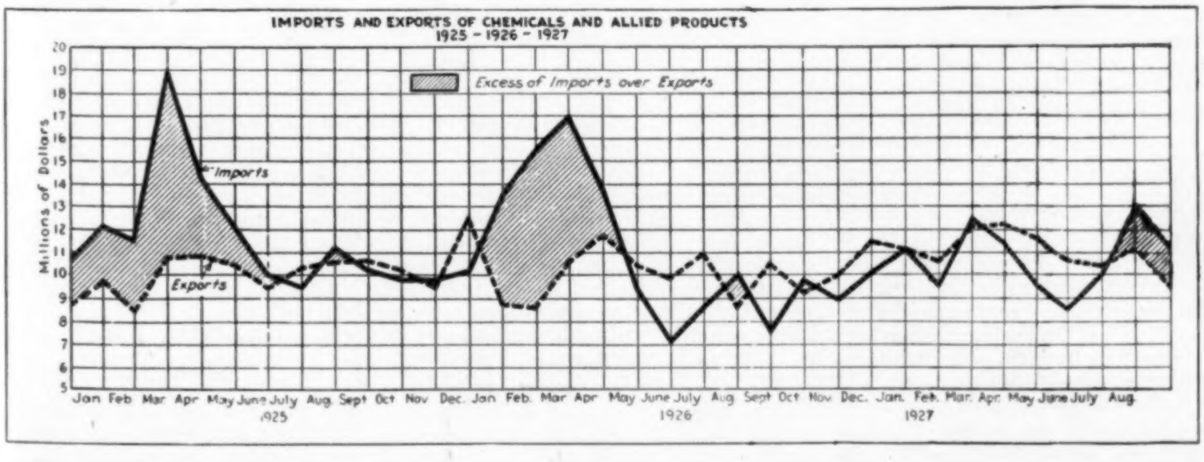
VOLUME OF PRODUCTION

(U.S. Department of Commerce)



FACTORY EMPLOYMENT

(U.S. Bureau of Labor Statistics)



MARKET CONDITIONS *and* PRICE TRENDS

New Contract Prices for Chemicals Favor Buyers

Lower Average Levels Foreseen As Result of Schedules So Far Announced

CHIEF INTEREST in the market for chemicals is still centered in contract business covering deliveries over 1928. In the majority of cases where changes have been announced in contract levels, the change has been in favor of buyers. The open quotations for soda ash, caustic soda, liquid chlorine, and nitrite of soda are lower than those established a year ago. The lowering in prices, however, does not actually represent the difference in prices existing in the present market and that of a year ago. This is explained by the fact that contract orders were accepted in the closing months of last year at prices below the open market figures and the new schedules have brought quotations more in line with the actual selling basis.

SINCE the new figures were made public a good volume of forward business has been placed and undoubtedly a large part of domestic production of certain chemicals will have been sold ahead before the close of the year. Already heavy trading in alkalies has been reported and the greater part of consumers of bichromates and of nitrite of soda is said to have covered requirements for next year. Interest in caustic potash for forward deliveries has increased following a lower selling price. The lower price for caustic potash was due in large measure to the intensity of foreign competition. In fact the influence of foreign material has been of importance in weakening values for different chemicals, notably nitrite of soda and sal ammoniac.

GENERAL industrial activity in southern states combined with higher prices obtained for cotton this season have a direct bearing on the fertilizer trade as consumption of mixed fertilizers centers in that section. Fertilizer tag for this season to date are about 10 per cent larger than a year ago. This condition prophesies a broader market for fertilizer chemicals and it is predicted that consumption of sulphuric acid in the fertilizer trade will exceed that of the last fiscal year. Nitrate of soda is attracting attention, not only because domestic consumption promises to be larger but also because of the recovery of values in primary markets which is said to be largely due to buying for European account. Should European consumers revert to the use of nitrate of soda to the degree of former years a continued firm market for this chemical would be logical. Incidentally the Chilean government has issued a decree whereby Chilean vessels are to be given a bounty when carrying cargoes of nitrate of soda to foreign ports.

PROMINENT among recent market developments has been the steadily downward price trend of spirits of turpentine and rosin. Favorable weather has extended the producing season and liberal receipts together with moderate buying has made it difficult to sustain values at a steady level. With production bound to decline and consuming industries becoming more active, it would appear that values are around bottom. Current prices are the lowest which have prevailed for several years and it is hardly probable that they will continue. The influence of smaller offerings should become a factor in the near future with a consequent appreciation of values.

A survey of calcium arsenate consumption during the last season reveals a disappointing condition. Boll weevil infestation was heavy throughout the cotton-growing district and arsenate treatment is admitted to be the most effective antidote to weevil ravages, yet consumption of arsenate was reported to have fallen below the total of the preceding season when weevil infestation was considerably less. Possibly the low prices obtained for cotton last year reacted against a freer buying of arsenate but in any event, consumption of the latter failed to come up to expectations and late season sales were increased only at the sacrifice of values.

Official figures covering the factory production of fats and oils, exclusive of refined oils and derivatives, during the third quarter of this year was as follows: vegetable oils, 524,720,075 lb.; fish oils, 36,869,026 lb.; animal fats, 484,996,341 lb.; and grease, 91,019,837 lb.; a total of 1,137,605,279 lb. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 372,972,417 lb. appears for lard. Next in order is cottonseed oil with 246,796,510 lb.; linseed oil with 169,273,970 lb.; tallow with 109,858,911 lb.; coconut oil with 65,606,934 lb.; and corn oil with 30,395,909 lb.

The production of refined oils during the period was as follows: cottonseed, 164,848,061 lb.; coconut, 57,003,280 lb.; peanut, 1,295,760 lb.; corn, 23,708,114 lb.; soya-bean, 2,258,807 lb.; and palm-kernel, 537,744 lb. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

SIR Alfred Mond, who is trying to wipe out tariff barriers within the British Empire, apparently is bringing his influence to bear on the chemical industries in the Dominions as a sort of example of what can be done by all industry. Advices reaching Washington are to the effect that the chemical manufacturers of Australia and New Zealand are ready to go along with such a plan. Steps to the same end are being taken in India. Canada is to be left until the last as it is recognized that opposition to any such plan will be greatest there. If the other Dominions can be lined up it is thought by the proponents of the scheme that a better opportunity will be offered to induce the Canadians to make it unanimous.

Rumors are reaching this country that the International Rayon Cartel is having troubles. Difficulties have arisen within and the combination has been assailed from without. The details seem not to be understood, but none will be surprised to see a diminution of the cartel's effectiveness in the near future and the rise of another powerful British factor in the rayon trade.

Commerce Secretary Hoover is planning to invite the members of his Chemical Advisory Committee to confer in Washington early in December. The exact date for the meeting had not been decided upon as this is written.

Import Duties Changed By Proclamation

In accordance with the flexible provisions of the Tariff Act, two changes in import duties have been established by decrees of the President. Under date of Oct. 31, announcement was made that the import duty on phenol had been reduced 50 per cent, making the new rate 20 per cent ad valorem and 3½c. per lb. On Nov. 10, a proclamation was issued whereby the import duty on crude magnesite was increased to fifteen thirty-seconds of one cent per lb. and that on caustic calcined magnesite increased to fifteen-sixteenths of one cent per lb. In both cases the changes were made in order to equalize differences in foreign and domestic production costs.

Competition Lowers Price of Caustic Potash

CAUSTIC potash of foreign origin has been very prominent in domestic markets in recent months. Import figures show that arrivals from abroad

MARKET CONDITIONS *and* PRICE TRENDS

in the nine months ended Oct. 31 were 11,412,759 lb., an increase of almost 23 per cent as compared with importations in the corresponding period of last year. As total domestic consumption of this chemical is said to be about 7,000 tons a year, it is evident that imported material has been in command of the market. Within the last month quotations for domestic caustic potash were reduced to 7⅛c. per lb. for the 88-92 per cent grade. For a time this gave an advantage to the home product but more recent reports indicate that importers are inclined to revise their quotations in order to meet competition. Producing costs abroad are said to be considerably lower than they are in this country and it is difficult to estimate how low prices in domestic markets must go in order to make it unprofitable for foreign factors to remain in the market.

Pyroxylin Varnish Output Still Increases

THE DEPARTMENT of Commerce announces that, according to data collected at the latest semiannual canvass of paint and varnish manufacturers, the production during the six-months period from January 1 to June 30, 1927, was as follows: 199,473,400 lb. of paste paints, comprising 132,795,900 lb. of pure white lead in oil, 15,877,800 lb. of combination or graded whites, 3,438,500 lb. of zinc oxide in oil, and 47,361,200 lb. of other paste paints; 50,662,100 gal. of ready-mixed and semipaste paints, including enamels; 34,831,100 gal. of varnishes, japans, and lacquers, other than pyroxylin; 14,929,000 gal. of pyroxylin (nitrocellulose) varnishes or lacquers; and allied products comprising paint and varnish removers, 522,400 gal. stains (not varnish stains), 1,897,800 gal.; liquid fillers, 431,000 gal.; paste fillers, 7,553,500 lb.; and putty, 28,528,400 lb.

The statistics for paints and varnishes for the first half of 1927 as compared with the second half of 1926 show a decrease of 6.1 per cent for paste paints, an increase of 11 per cent for ready-mixed and semipaste paints, including enamels; a decrease of 3.9 per cent for varnishes, japans, and lacquers, other than pyroxylin; and an increase of 16.2 per cent for pyroxylin varnishes or lacquers.

The statistics for the first half of 1927 are based on returns from 580 establishments, of which 103 reported the manufacture of pure white lead in oil; 183, combination or graded whites; 151, zinc oxide in oil; 342, other paste paints; 428, ready-mixed and semipaste paints; 352, varnishes, japans, lacquers, other than pyroxylin; and 145, pyroxylin varnishes or lacquers.

Statistics of production with comparisons for preceding years follow:

Paint and Varnish Production

		Paste Paints Lb.	Ready Mixed and Semi-paste Paints Gal.	Varnishes, Japans and Lacquers Gal.
1927	First half	199,473,000	50,662,000	49,760,000
1926	Second half	212,537,000	45,623,000	49,086,000
	First half	209,023,000	45,402,000	48,218,000
1925	Second half	224,228,000	47,260,000	40,622,000
	First half	241,057,000	52,449,000	41,395,0u0
1924	Second half	233,867,000	43,152,000	34,301,000
	First half	253,744,000	45,122,000	36,149,000
1923	Second half	192,021,000	38,551,000	32,849,000
	First half	247,154,000	43,712,000	37,882,000

Restricted Production for Alcohol in 1928

ALCOHOL production in 1928 is to be limited to 85,000,000 gal. Manufacturers and officials of the prohibition unit agreed on this figure at a conference held on Nov. 4. The output as prescribed will represent a decline of about 10,000,000 gal. from 1927 production. For some time alcohol production has been greater than the actual need, stocks have been increasing and excessive inventories have been carried, and the trade recognized the need of decreasing the production somewhat. Not all this 10,000,000 gallon surplus found its way into illegal uses, as much of it was put into storage. This agreement will tend to stabilize the industry by limiting production to the actual needs of legitimate users. As this need changes the production quotas will be revised by the council.

Consumers were assured that this plan will not involve any increase in prices or restriction on the amount of alcohol that may be used; in fact, it seemed to be the opinion of the producers that prices may decline a little in the next few months. Alcohol prices will continue to depend on the Cuban molasses market. Representatives of consumers are in the majority on the council, and if consumers feel that production is too much curtailed they can easily secure a revision of the allotments.

Different reports are heard relative to the amount of alcohol in possession of second hands at present but the market is not depressed by such offerings and with production scheduled to harmonize with actual consuming needs the prospects are favorable for a steadier price movement in the future market for alcohol.

Imports of Chemicals

	September 1927	September 1926
Dead or creosote oil, gal	6,989,937	3,678,136
Pyridine, lb	9,328	36,885
Coal-tar acids, lb	6,000	25,859
Coal-tar intermediates, lb	35,016	52,573
Arsenic, lb	2,807,740	446,083
Acid, citric, lb	....	12,320
Acid, formic, lb	232,254	178,773
Acid, oxalic, lb	134,264	102,995
Acid, sulphuric, lb	1,878,454	3,031,983
Acid, tartaric, lb	246,937	133,827
Ammonium chloride, lb	1,477,770	1,417,957
Ammonium nitrate, lb	972,245	968,441
Barium compounds, lb	907,608	720,79?
Calcium carbide, lb	112,002	510,000
Cobalt oxide, lb	30,100	10,500
Copper sulphate, lb	....	184,625
Bleaching powder, lb	198,131	328,643
Lime citrate, lb	....	....
Glycerine, crude, lb	1,661,937	2,790,115
Glycerine, refined, lb	515,786	1,262,310
Magnesium compounds, lb	1,729,056	2,752,880
Potassium cyanide, lb	24,434	....
Potassium carbonate, lb	504,053	794,631
Potassium nitrate, ton	605	....
Caustic potash, lb	1,240,251	764,015
Cream of tartar, lb	36,736	11,211
Potassium chlorate, lb	918,563	1,152,096
Sodium cyanide, lb	1,838,205	2,491,172
Sodium ferrocyanide, lb	189,184	55,587
Sodium nitrate, ton	64,753	37,096
Sodium nitrite, lb	2,369	44,877
Sulphate of ammonia, ton	4,408	253

Exports of Chemicals

	September 1927	September 1926
Benzol, gal	996,270	2,422,299
Crude coal-tar and pitch, bbl	7,279	6,776
Acid, sulphuric, lb	454,326	384,061
Other acids, lb	683,913	1,053,771
Methanol, gal	20,526	38,779
Ammonia and compounds, lb	258,404	396,492
Aluminum sulphate, lb	3,525,303	3,974,465
Acetate of lime, lb	....	1,392,453
Calcium carbide, lb	578,731	522,712
Bleaching powder, lb	932,582	1,591,418
Copper sulphate, lb	422,661	374,904
Formaldehyde, lb	101,928	220,063
Potassium compounds, lb	252,137	81,035
Sodium bichromate, lb	711,048	566,684
Sodium cyanide, lb	68,375	72,944
Borax, lb	5,410,060	2,001,479
Sodium silicate, lb	4,840,038	4,326,155
Sal soda, lb	1,633,989	901,883
Caustic soda, lb	5,336,973	8,558,072
Bicarbonate of soda, lb	1,214,596	1,667,419
Sulphate of ammonia, ton	9,907	28,005
Sulphur, ton	53,954	40,011

Glaubers Salt Combination Renewed in Europe

It is reported that the Anglo-German Glaubers Salt Foreign Sales Convention has been renewed until 1930. Participants in the Convention are the Imperial Chemical Industries, the I. G. Farbenindustrie A. G., and the Wintershall potash interests. The report places the allocation of the Wintershall group at 45 per cent of the total export quota.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**112.02**
Last month	112.37
November, 1926	114.13
November, 1925	112.77

Lower contract prices for soda ash, caustic soda, and nitrite of soda together with declines in tin salts, caustic potash and other chemicals have given an easier tone to the market and the weighted index number shows a decline for the month.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**132.90**
Last month	133.77
November, 1926	133.76
November, 1925	155.69

An easier price trend ruled in the oil market with linseed oil leading the downward movement. China wood, peanut, and corn oils also were lower. Glycerine likewise eased off with demand not up to expectations.

CURRENT PRICES *in the* NEW YORK MARKET

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to November 14.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.12 -$0.13	$0.12 -$0.13	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.38 - 3.63	3.38 - 3.63	3.25 - 3.50
Boric, bbl	lb.	.08½- .08¾	.08½- .08¾	.08½- .11
Citric, kegs	lb.	.44½- .45	.44½- .45	.45 - .47
Formic, bbl.	lb.	.11 - .12	.10½- .11	.10½- .11
Gallic, tech., bbl	lb.	.50 - .55	.50 - .55	.45 - .50
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.13½- .14	.13½- .14	.13½- .14
22%, tech., light, bbl	lb.	.06½- .07	.06½- .07	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - .90
Nitric, 36°, carboys	cwt.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.10½- .11
Phosphoric, tech., c'bys	lb.	.08½- .09	.08½- .09	.07 - .07½
Sulphuric, 60°, tanks	ton	10.50 -11.00	10.50 -11.00	10.50 -11.00
Tannic, tech., bbl	lb.	.35 - .40	.35 - .40	.35 - .40
Tartaric, powd., bbl	lb.	.36 - .37½	.37 - .37½	.29 - .30
Tungstic, bbl	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p'f. U.S.P. bbl	gal.	3.75 - 4.00	3.75 - 4.00	4.85 - 4.90
Alcohol, Butyl, dr	lb.	.19 - .20½	.19½- .20½	.18½- .19
Denatured, 190 proof No. 1 special dr	gal.	.48 -......	.48	.31 -......
No. 5, 188 proof, dr.	gal.	.48 -......	.48	.31 - .32
Alum, ammonia, lump, bbl	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl	lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl	lb.	.02¾- .03½	.02¾- .03½	.02¾- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Aqua ammonia, 26°, drums	lb.	.02¾- .03	.02¾- .03½	.03½- .04
Ammonia, anhydrous, cyl.	lb.	.11½- .13	.11 - .15	.13 - .15
Ammonium carbonate, powd. tech., casks	lb.	.10½- .14	.10½- .14	.11 - .14
Sulphate, wks.	cwt.	2.40 -......	2.25 -......	2.50 -......
Amylacetate tech., drums	gal.	1.75 - 2.00	2.15 - 2.20	1.80 - 1.90
Antimony Oxide, bbl.	lb.	.15 - .16½	.16 - .17½	.14½- .15
Arsenic, white, powd., bbl.	lb.	.04 - .04½	.04 - .04½	.03¾- .04½
Red, powd., kegs	lb.	.09½- .10	.09½- .10	.11 - .12
Barium carbonate, bbl	ton	50.00 -52.00	50.00 -52.00	48.00 -50.00
Chloride, bbl.	ton	56.00 -58.00	58.00 -60.00	63.00 -65.00
Nitrate, cask	lb.	.08 - .08½	.08 - .08½	.07½- .08
Blanc fixe, dry, bbl	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.04 - .04½	.04½- .05	.05 - .05½
Bromine, cs	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	3.50 -......	3.50 -......	3.25 - 3.50
Arsenate, dr	lb.	.07½- .08	.07½- .08	.07½- .08
Carbide drums	lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks.	ton	21.00 -.....	21.00 -.....	21.00 -......
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums	lb.	.05½- .06	.05½- .06	.05½- .06
Tetrachloride drums	lb.	.06¾- .07	.06¾- .07	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.03½- .04½	.04 - .04½	.04 - .04½
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.00 - 2.10	2.00 - 2.10	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	14.00 -17.00	14.00- 17.00	13.00 -15.00
Copper carbonate, bbl	lb.	.17 - .17½	.17 - .18	.16½- .17
Cyanide, tech., bbl	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	5.00 - 5.10	5.00 - 5.10	4.90 - 5.00
Cream of tartar, bbl.	lb	.27 - .28	.27½- .28	.21 - .22
Diethylene glycol, dr.	gal.	.15 - .20	.15 - .20	.... - ....
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.35 - 1.40
Ethyl acetate, 85% drums	gal.	.74 - .76	.74 - .76	.74 - .76
Formaldehyde, 40%, bbl	lb.	.08½- .08½	.08½- .11½	.09 - .09½
Furfural, dr.	lb.	.15 - .17½	.15 - .17½	.15 - .17
Fusel oil, crude, drums	gal.	1.30 - 1.40	1.30 - 1.40	1.40 - 1.50
Refined, dr	gal.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Glaubers salt, bags	cwt.	1.00 - 1.15	1.00 - 1.10	1.20 - 1.40
Glycerine, c.p., drums, extra	lb.	.22½- .24	.23 - .24	.30 -......
Lead: White, basic carbonate, dry, casks	lb.	.09 -.....	.09 -.....	.10½-......
White, basic sulphate, sck.	lb.	.08½-	.08½-.....	.09½-......
Red, dry, sck	lb.	.09¾-......	.09¾-.....	.11¾-......
Lead acetate, white crys., bbl.	lb.	.13 - .13½	.13 - .13½	.14½-......
Lead arsenate, powd., bbl	lb.	.12 - .13	.12 - .13	.14 - .15
Lime, chem., bulk	ton	8.50 -......	8.50 -	8.50 -......
Litharge, pwd., csk	lb.	.08¾-......	.08¾-	.10¾-......
Lithopone, bags	lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags	lb.	.07½- .08	.07½- .08	.06½- .06¾
Methanol, 95%, dr	gal.	.53 -...55	.53 -	.75 -......
97%, dr.	gal.	.55 -......	.55 -	.77 -......
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl	lb.	.10½- .11	.10½- .11	.10 - .11

		Current Price	Last Month	Last Year
Orange mineral, csk.	lb.	.11¾-......	.11¾-......	.13½-......
Phosphorus, red, cases	lb.	.62 - .65	.62 - .65	.65 - .68
Yellow, cases	lb.	.32 - .33	.32 - .34	.33 - .34
Potassium bichromate, casks	lb.	.08½- .08¾	.08½- .08¾	.08½- .08¾
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.05½- .06	.06½- .06¾
Chlorate, powd.	lb.	.08½- .09	.08½- .09	.08½- .09
Cyanide, cs.	lb.	.55 - .57	.55 - .58	.55 - .57
First sorts, csk.	lb.	.09 - .09½	.08¾- .09	.08¾- .09
Hydroxide (c'stic potash) dr.	lb.	.07½- .07¾	.07½- .07¾	.07½- .07½
Muriate, 80% bgs	ton	36.40 -.....	36.40 -.....	36.00 -.....
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums	lb.	.15 - .16	.14 - .15	.14½- .15
Prussiate, yellow, casks	lb.	.18 - .19	.18½- .19	.18 - .19
Sal ammoniac, white, casks	lb.	.05 - .05½	.05½- .06¾	.05¾- .06
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.90 - .95
Salt cake, bulk	ton	17.00 -18.00	17.00 -18.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32 -.....	1.32½-......	1.38 -......
Dense, bags	cwt.	1.35 -......	1.37½- 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract	cwt.	2.80 - 3.00	3.00 -......	3.10 -......
Acetate, works, bbl.	lb.	.04½- .05½	.04½- .05	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.06½- .06½	.06½- .06¾	.06½- .06¾
Bisulphate, bulk	ton	3.00 - 3.50	5.00 - 5.50	6.00 - 7.00
Bisulphite, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chlorate, kegs	lb.	.06½- .06½	.06½- .06½	.06½- .06½
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.19 - .22
Fluoride, bbl.	lb.	.08½- .09	.08½- .09	.08½- .09
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	2.65 - 3.00
Nitrate, bags	cwt.	2.40 -......	2.30 -......	2.36 -......
Nitrite, casks	lb.	.08½- .08½	.08½- .08½	.08½- .09
Phosphate, dibasic, bbl.	lb.	.03 - .03½	.03½- .03¾	.03½- .03¾
Prussiate, yel. drums	lb.	.12 - .12½	.12 - .12½	.10 - .10½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.03½- .04	.03½- .04	.02¾- .03
Sulphite, crys., bbl	lb.	.03 - .03½	.03 - .03½	.02½- .03
Strontium nitrate, bbl.	lb.	.09 - .09½	.08½- .09	.08½- .09
Sulphur, crude at mine, bulk	ton	19.00 -......	19.00 -......	19.00 -20.00
Chloride, dr	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.70 - 3.00
Tin bichloride, bbl.	lb.	.17½-......	.17¾-......	.19 -......
Oxide, bbl.	lb.	.64 -......	.64 -......	.67 -......
Crystals, bbl.	lb.	.41½-......	.42 -......	.48 -......
Zinc chloride, gran., bbl.	lb.	.06½- .06¾	.06½- .06½	.07 - .07½
Carbonate, bbl.	lb.	.10 - .11	.10 - .10½	.10½- .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.09 - .10	.10½- .11	.09 - .10
Zinc oxide, lead free, bag.	lb.	.06½-......	.06½-......	.07½-......
5% lead sulphate, bags	lb.	.06½-......	.06½-......	.07½-......
Sulphate, bbl	cwt.	2.75 - 3.00	2.75 - 3.00	2.75 - 3.00

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.13 -$0.13½	$0.13 -$0.13½	$0.12½-$0.13
Chinawood oil, bbl.	lb.	.15½-......	.15 -......	.16½-......
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08¾-......	.08½-......	.09½-......
Corn oil crude, tanks, (f.o.b. mill)	lb.	.09¾-......	.10 -......	.10¾-......
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09½-......	.09½-......	.06¾-......
Linseed oil, raw, car lots, bbl.	lb.	.96 -......	.101 -......	.107 -......
Palm, Lagos, casks	lb.	.08 -......	.07¾- .08	.08¾-......
Niger, casks	lb.	.07½-......	.07½- .07½	.08½-......
Palm Kernel, bbl.	lb.	.09 -......	.09 -......	.10½-......
Peanut oil, crude, tanks(mill)	lb.	.09½-......	.10 -......	.13 -......
Perilla, bbl.	lb.	.... -......	.... -......	.... -......
Rapeseed oil, refined, bbl.	gal	.85 - .86	.85 - .86	.84 - .86
Sesame, bbl.	lb.	.... -......	.... -......	.... -......
Soya bean tank (f.o.b. Coast)	lb	.09½-......	.09½-......	.10½-......
Sulphur (olive foots), bbl.	lb	.10 -......	.09½-......	.08½-......
Cod, Newfoundland, bbl	gal.	.63 - .62	.63 - .64	.60 - .65
Menhaden, light pressed, bbl.	gal.	.60 - .66	.60 - .62	.65 - .68
Crude, tanks (f.o.b. factory)	gal.	.44 -......	.45 -......	.45 -......
Whale, crude, tanks	lb.	.... -......	.... -......	.... -......
Grease, yellow, loose	lb.	.06¾-......	.06½-......	.08½-......
Oleo stearine	lb.	.12½-......	.12½-......	.12½-......
Red oil, distilled, d.p. bbl.	lb.	.09½- .09½	.09½- .10	.10 - .10½
Tallow, extra, loose	lb.	.08¾-......	.08 -......	.07½-......

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl	lb.	.85 - .90	.85 - .90	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra.	lb.	.15 - .16	.15 - .16	.16 - .16½
Aniline salts, bbl	lb.	.24 - .25	.24 - .25	.22 - .23
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - .65

Coal Tar Products (Continued)

	Current Price	Last Month	Last Year
Benzaldehyde, U.S.P., dr.... lb.	$1.15 -$1.25	$1.15 -$1.35	$1.30 -$1.35
Benzidine base, bbl......... lb.	.70 - .72	.70 - .75	.72 - .74
Benzoic acid, U.S.P., kgs.... lb.	.58 - .60	.58 - .60	.56 - .60
Benzyl chloride, tech, dr.... lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works... gal.	.24 - .25	.24 - .25	.24 - .25
Beta-naphthol, tech., drums. lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr........... lb.	.18 - .20	.18 - .20	.18 - .20
Cresylic acid, 97%, dr., wks. gal.	.61 - .62	.61 - .62	.60 - .65
Diethylaniline, dr........... lb.	.58 - .60	.58 - .60	.58 - .60
Dinitrophenol, bbl........... lb.	.31 - .35	.31 - .33	.31 - .35
Dinitrotoluen, bbl........... lb.	.17 - .18	.17 - .18	.18 - .20
Dip oil, 25% dr.............. gal.	.28 - .30	.28 - .30	.28 - .30
Diphenylamine, bbl.......... lb.	.45 - .47	.45 - .47	.48 - .50
H-acid, bbl.................. lb.	.63 - .65	.63 - .65	.65 - .66
Naphthalene, flake, bbl..... lb.	.04½- .05	.04½- .05	.06½- .07
Nitrobenzene, dr............ lb.	.09 - .10	.09 - .10	.09 - .10
Para-nitraniline, bbl........ lb.	.52 - .53	.52 - .53	.50 - .53
Para-nitrotoluine, bbl....... lb.	.28 - .32	.28 - .32	.40 - .42
Phenol, U.S.P., drums....... lb.	.18 - .19	.18 - .19	.17 - .18
Picric acid, bbl............. lb.	.30 - .40	30 - .40	.25 - .26
Pyridine, dr................. lb.	3.00 -......	3.00 -......	3.90 - 4.00
R-salt, bbl.................. lb.	.47 - .50	.47 - .50	.50 - .55
Resorcinal, tech, kegs....... lb.	1.30 - 1.35	1.35 - 1.40	1.30 - 1.40
Salicylic acid, tech., bbl.... lb.	.30 - .32	.30 - .32	.32 - .33
Solvent naphtha, w.w., tanks. gal.	.35 -......	.35 -......	.35 -......
Tolidine, bbl................ lb.	.95 - .95	.95 - .96	.90 - .95
Toluene, tanks, works....... gal.	.35 -......	.35 -......	.35 -......
Xylene, com., tanks......... gal.	.36 - .41	.36 - .41	.36 - .40

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl..... ton	$23.00-$25.00	$23.00-$25.00	$23.00-$25.00
Casein, tech., bbl........... lb.	.17½- .18	.17 - .18	.16 - .17
China clay, dom., f.o.b. mine ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:			
Carbon gas, black (wks.).. lb.	.06½- .07	.06½- .07	.08 - .08½
Prussian blue, bbl.......... lb.	.33 - .34	.33 - .34	.32 - .33
Ultramine blue, bbl........ lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl......... lb.	.27 - .31	.27 - .30	.28 - .30
Carmine red, tins.......... lb.	5.50 - 5.75	5.50 - 5.75	5.10 - 5.85
Para toner................. lb.	.80 - .90	.80 - .90	.90 - .95
Vermilion, English, bbl.... lb.	1.80 - 1.85	1.80 - 1.85	1.45 - 1.50
Chrome yellow, C. P., bbl. lb.	.17 - .18	.17 - .18	.17½- .18
Feldspar, No. 1 (f.o.b. N. C.) ton	5.75 - 7.00	5.75 - 7.00	6.00 - 6.50
Graphite, Ceylon, lump, bbl. lb.	.07½- .08	.07½- .09½	.09 - .10
Gum copal, Congo, bags...... lb.	.09½- .10	.09½- .10	.09½- .10
Manila, bags............... lb.	.15 - .18	.15 - .16	.14 - .10
Damar, Batavia, cases..... lb.	.25 - .25½	.25 - .26	.25 - .25
Kauri, No. 1 cases......... lb.	.55 - .57	.55 - .57	.58 - .62
Kieselguhr (f.o.b. N. Y.).... ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.............. ton	44.00 -......	44.00 -......	38.00 -42.00
Pumice stone, lump, bbl..... lb.	.05 - .07	.05 - .08	.04½- .06
Imported, casks............ lb.	03 - .40	.03 - .40	.03 - .35
Rosin, H.................... bbl.	8.35 -......	9 10 -......	13.50 -......
Turpentine.................. gal.	.49½-......	.57 -......	.87 -......
Shellac, orange, fine, bags... lb.	.52 - .53	52 - 53	48 - 50
Bleached, bonedry, bags... lb.	.55 - .58	55 - .58	52 - 54
T. N. bags................. lb.	48 - .49	48 - .49	43 - .44
Soapstone (f.o.b. Vt.), bags.. ton	10.00 -12.00	10 00 -12.00	9.00 -11.00
Talc, 200 mesh (f.o.b. Vt.)... ton	10.50 -......	10.50 -......	10.50 -......
200 mesh (f.o.b. Ga.)...... ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
325 mesh (f.o.b. N. Y.).... ton	13.75 -......	13.75 -......	14.75 -......

	Current Price	Last Month	Last Year
Wax, Bayberry, bbl......... lb.	$0.22 -$0.26	$0.22 -$0.26	$0.20 -$0.21
Beeswax, ref., light........ lb.	.43 - .45	.43 - .47	.46 - .47
Candelilla, bags........... lb.	.27 - .28	.27 - .28	.36 - .37
Carnauba, No. 1, bags.... lb.	.62 - .62	.62 - .62	.62 - .62
Paraffine, crude 105-110 m.p............ lb	.05½- .06	.05½- .06	05½- .06

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%...... ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferrochromium, 1-2%....... lb.	.23- .25	.23- .35	.23- ...
Ferromanganese, 78-82%.... ton	90.00-.....	90.00-.....	88.00-90.00
Spiegeleisen, 19-21%........ ton	33.00-35.00	33.00-35.00	33.00-34.00
Ferrosilicon, 10-12%........ ton	33.00-38.00	33.00-38.00	33.00-38.00
Ferrotungsten, 70-80%...... lb.	.95- 1.00	.95- 1.00	1.05- 1.10
Ferro-uranium, 35-50%..... lb.	4.50-.....	4.50-.....	4.50-.....
Ferrovanadium, 30-40%..... lb.	3.15- 3.75	3.15- 4.00	3.25- 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic......... lb.	$0.13½-......	$0.13½ -......	$0.14½-......
Aluminum, 96-99%.......... lb.	.25 - .26	.26 - .27	.27 - .28
Antimony, Chin. and Jap.... lb.	.11 - .12½	.12 - .12½	15½- .16
Nickel, 99%................. lb.	.35 -......	.35 -......	.35 -......
Monel metal, blocks........ lb.	.32 - .33	.32 - .33	.32 - .33
Tin, 5-ton lots, Straits...... lb.	.56½-......	.57½-......	.64½-......
Lead, New York, spot....... lb.	6 25 -......	6.25 -......	8 40 -......
Zinc, New York, spot....... lb.	5.95 -......	6.45 -......	7.65 -......
Silver, commercial.......... oz.	.57½-......	.57½-......	.63½-......
Cadmium.................... lb.	.60 -......	.60 -......	.60 -......
Bismuth, ton lots........... lb.	1.85 - 2.10	1.85 - 2.00	2.70 - 2.75
Cobalt...................... lb.	2.50 -......	2.50 -......	3.00
Magnesium, ingots, 99%.... lb.	.75 - .80	.75 - .80	.75 - .80
Platinum, ref............... oz.	66 00-......	72 00-......	111.00-......
Palladium, ref.............. oz.	52.00- 53.00	53.00- 54.00	69.00-71.00
Mercury, flask.......... 75 lb.	128 00-......	127.00-......	99.50-......
Tungsten powder........... lb.	1.05- 1 15	1.05-......	1.10-......

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks....... ton	$5.50- $8.50	$5.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post........ ton	22.00- 24.00	22.00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens.... ton	3.75- 4.25	3.75- 4.25	3.75- 4.25
Fluorspar, gravel, f.o.b. Ill.... ton	17.00- 18.00	17.00-......	18.00-......
Ilmenite, 52% TiO_2, Va..... lb.	.00¾ .00¾	.00¾ .00¾	.01½-......
Manganese ore, 50% Mn., c.i.f. Atlantic Ports....... unit	.36 - .38	36 - .38	.40 - .42
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y........... lb.	.48 - .50	.48 - .50	.65- .70
Monazite, 6% of ThO_2...... ton	120.00-......	120.00-......	120.00-......
Pyrites, Span. fines, c.i.f..... unit	.13½-......	.13½-......	.13½-......
Rutile, 94-96% TiO_2........ lb.	.11 - .13	.11 - .13	.12 - .15
Tungsten, scheelite, 60% WO_3 and over....... unit	10 35 -10.60	11.25 -11.50	12.50 -13.00
Vanadium ore, per lb. V_2O_5.. lb.	.25 - .28	.25 - .30	.30 - .35
Zircon, 99%................ lb.	03 - ...	.03 -......	.03 -......

Current Industrial Developments

New Construction and Machinery Requirements

Acid Factory—Owner, c/o C. V. Badger, 191 Merrimack St., Haverhill, Mass., Archt., is receiving bids for a 2 story, 60 x 110 ft. acid factory. Estimated cost $65,000.

Asphalt Plant—City of Montreal, Que., will soon receive bids for the construction of an asphalt plant. Estimated cost $300,000.

Brewery Addition—M. K. Goetz Brewing Co., Sixth and Albermarle Sts., St. Joseph, Mo., awarded contract for a 4 story, 45 x 61 and 30 x 65 ft. addition to brewery to Lawhon Construction Co., 110 North 9th St., St. Joseph. Estimated cost $75,000.

Brick and Tile Plant—Hinkly Brick & Tile Co., W. B. Hinkly, San Benito, Tex., plans extensions and improvements to brick and tile plant. Estimated cost $50,000. Machinery and equipment will be required.

Candy Factory—Detroit Candy Co., 1528 Gratiot Ave., Detroit, Mich., awarded contract for a 3 story, 70 x 100 ft. candy factory to C. O. Barton Co., 508 Free Press Bldg., Detroit, Mich. Estimated cost $150,000.

Candy Factory—National Candy Co., 208 North Broadway, St. Louis, Mo., awarded contract for a 5 story candy factory at Grovois and Bingham Aves. to Gamble Construction Co., 620 Chestnut St., St. Louis, Mo. Estimated cost $1,000,000.

Candy Factory — New England Confectionery Co., 253 Summer St., Boston, Mass., awarded contract for a 6 story addition to candy factory at Summer and Belcher Sts. to C. A. Dodge, 2 Erie St., Cambridge, Mass. Estimated cost $150,000.

Chemical Factory — Hillyard Chemical Co., 9th and Mary Sts., St. Joseph, Mo., will soon receive bids for a 3 story chemical factory at 8th and Olive Sts. Estimated cost $100,000. E. R. Meier, Logan Bldg., St. Joseph, Mo., is architect.

Chemical Plant—Louisiana Chemical Co., Baton Rouge, La., plans addition to chemical plant to double the capacity. Estimated cost $250,000. S. Peiser, Pres. of Texas Chemical Co., in charge.

Chemical Plant — Richards & Co., Inc., Ludlow St., Stamford, Conn., plans to rebuild chemical plant recently destroyed by fire. Estimated cost $40,000.

Chemical Plants—Union Carbon & Carbide Co., 30 East 42nd St., New York, N. Y., is having plans prepared for the construction of chemical plants at Hastings and Charleston, W. Va. Estimated cost $1,000,000 and $500,000 respectively. Compressors, motors, etc. will be required.

Clay Pipe and Products Plant — Pine Hall Brick Co., F. F. Steele, Pres., Pine Hall, N. C., plans the construction of a plant for the manufacture of vitrified salt glazed sewer pipe, drain tile, silo tile and other vitrified clay products. Estimated cost $250,000.

Coke Oven Equipment — Utilities Engineering Co., Muskegon, Mich., plans to purchase coke oven equipment for proposed 20-oven coke plant.

Coke Ovens and Coal Handling Plant—Youngstown Sheet & Tube Co., Youngstown, O., awarded contract for the construction of 71 by-product coke ovens also coal handling plant at Chicago, Ill. to The H. Koppers Co., Union Trust Bldg., Pittsburgh, Pa. Estimated cost $3,000,000.

Compressed Gas Plant—Linde Air Products Co., subsidiary of Union Carbon & Carbide Co., 30 East 42nd St., New York, N. Y., is having plans prepared for the construction of a compressed gas plant at Allentown, Pa. Estimated cost $150,000. Compressors, motors, etc., will be required.

Copper Rolling Mill—Baltimore Copper Smelting & Rolling Co., Canton St., Baltimore, Md., plans the construction of a 1 story, 108 x 396 ft. copper rolling mill at Fifth Ave. and Eighth St., also 1 story, 42 x 140 ft. warehouse at Clinton Ave. and Fourth St. Estimated cost $165,000.

Gasoline Plant — Roxana Oil Co., City National Bank Bldg., San Antonio, Tex., plans the construction of a gasoline plant in Rosenfield pool near Brownwood, Tex. Estimated cost $150,000. Work will be done by owners forces. New machinery and equipment will be required.

Gas Plant — Cities Service Gas Co., Ottawa, Kan., will build a 1 story, 70 x 120 and 30 x 120 ft. gas plant on Logan St. Estimated cost $600,000. Work will be

done by separate contracts under the supervision of C. A. Caddin, 234 Maple St., Supt. of construction.

Glass Factory—Kimble Glass Co., Vineland, N. J., awarded contract for a 2 and 3 story 52 x 160 and 24 x 40 ft. glass factory to H. John Homan Co., 18th and Cherry Sts., Philadelphia, Pa.

Glass Factory—M. H. Treadwell Co. Inc., 140 Cedar St., New York, N. Y., awarded contract for a 1 story, 120 x 200 ft. glass factory, etc. at Tonnelle Ave. between Thorne and Bleeker Sts. to M. T. Connolly, Secaucus Rd., Secaucus, N. J. Estimated cost $40,000.

Insulator Plant—Insulator Corp., Charles and Cromwell Sts., Baltimore, Md., awarded contract for the construction of a plant for the manufacture of electric porcelain insulators, etc. to Smith and O'Brien, 532 North Calvert St.

Japanning Plant—Hopkinson Japanning Co., c/o M. Kaplin, Controlling Stockholder, 123 Gardener Rd., Brookline, Mass., plans to rebuild japanning plant at North Woburn, Mass. recently destroyed by fire. Estimated cost $100.000. Architect not selected.

Laboratory — Canadian International Paper Co., 1153 Notre Dame St., Montreal, Que., had plans prepared for a 3 story, 42 x 143 ft. laboratory, etc. at Temiskaming, Que. Estimated cost $150,000. W. L. Somerville, 2 Bloor St. W., Toronto, Ont., is architect.

Laboratory—State of Connecticut, F. L. Salmon, State Comptroller, State House, Hartford, Conn., will receive bids until Nov. 15 (extended date) for a 3 story, 60 x 110 and 60 x 220 ft. laboratory at Storrs, Conn., for Connecticut Agricultural College. Estimated cost $354,000. D. K. Perry, 17 Court St., New Britain, Conn., is architect.

Laboratory (Chemistry) — Trustees of Trinity College, R. B. Ogilby, Pres., Hartford, Conn., is having plans prepared for a chemistry laboratory, etc. Estimated cost $150,000. Equipment will be required.

Laboratory (Chemistry) — U. S. Bureau of Fisheries, Woods Hole, Mass., awarded contract for a 2 story chemistry laboratory to Thomas Kelleher, Sandwich, Mass.

Laboratory Equipment—Chrysler Motor Corp., 341 Massachusetts Ave., Highland Park, Mich., plans to purchase engineering laboratory equipment for proposed 4 story, 60 x 400 ft. automobile factory.

Laboratory Equipment — University of Tennessee, O. W. Hyman, Dean, Union Ave., Memphis, Tenn., will receive bids until Nov. 30 for laboratory equipment, etc., for proposed pharmacy and library buildings.

Laboratory, etc. — Bureau of Yards & Docks, Navy Dept., Washington, D. C., plans the construction of a laboratory, etc. at Naval Operating Base (Hospital) Pearl Harbor, T. H.

Laboratory (Engineering) — Haverford College, W. W. Comfort, Pres., Haverford, Pa., plans the construction of a 3 story engineering laboratory. Estimated cost $100,000. Mellor Meigs & Howe, 205 South Juniper St., Philadelphia, Pa., are architects.

Laboratories—Bd. of Education, J. G. Ludlam, Secy., 15th and North Sts., Lincoln, Neb., will receive bids about Jan. 1 for a 2 story, 130 x 265 ft. junior high school including laboratories, etc. at 11th and B Sts. Estimated cost $300,000. Davis & Wilson, 525 South 13th St., Lincoln, Neb., are architects.

Nitroglycerin Plant—United States Torpedo Co., Fort Stockton, Tex., has acquired a 40 acre site and plans the construction of a plant for the manufacture of nitroglycerin for shooting oil wells. Estimated cost $150,000.

Oil Blending Plant—Hudson Oil Co., 109 Broad St., Newark, N. J., will build a 1 story blending plant at Doremus Ave. Estimated cost $60,000. E. A. Self, 247 Park Ave., New York, N. Y., is architect. Work will be done by separate contracts.

Oil Distribution Plant—Petroleum Securities Co., Petroleum Securities Bldg., Los Angeles, Calif., is having plans prepared for the construction of an oil distribution plant at Point Potrero, Richmond, Calif. Estimated cost $2,000,000. Private plans.

Oxygen Plant—Kentucky Oxygen-Hydrogen Co., Logan and Goss Sts., Nashville, Tenn. plans the construction of an oxygen plant at 25th and Cedar Sts. Estimated cost $150,000.

Paint Factory—Boydell Bros. White Lead & Color Co., Palmer and Cardoni Aves., Detroit, Mich., awarded contract for a 1 and 2 story paint factory to C. O. Barton, 508 Free Press Bldg., Detroit, Mich. Equipment will be installed.

Paint Factory Addition—Arneste Paint Co., 548 West 46th St., New York, N. Y., will receive bids to close about Jan. 10 for addition to paint factory. Estimated cost $40,000. Cohen & Siegel, 45 West 57th St., are architects.

Paper Mill—Fisher Bros. Paper Co., 120 West Columbia St., Fort Wayne, Ind., is having plans prepared for a 3 story, 40 x 150 ft. paper mill at Clinton and Columbia Sts. Estimated cost $46,000. A. M. Strauss, 415 Cal-Wayne Bldg., Fort Wayne, Ind., is architect.

Paper (Gummed) Plant—McLaurin-Jones Co., Brookfield, Mass., awarded contract for a 2 story addition to gummed paper plant to M. C. Tuttle Co., Park Sq. Bldg., Boston, Mass. Estimated cost $75,000.

Paper Mill—American Reinforced Paper Co., County St., Attleboro, Mass., awarded contract for a 1 story, 60 x 170 ft. paper mill on Starkey Ave. to C. K. Rathbone, 112 Medway St., Providence, R. I. Estimated cost $50,000.

Paper Mill—Northwestern Paper Co., Cloquet, Minn., plans the construction of a group of buildings for paper mill. Estimated cost $1,000,000. Jacobson Engineering Co., 904 Plymouth Bldg., Minneapolis, Minn., are engineers. Sulphating equipment will be required.

Number and Value of Industrial Building Contracts in First Nine Months of 1926 and 1927

Millions of Dollars (000 omitted)

	1926	1927
Chemical and process		
Value	$13,852,000	$13,195,000
Number contracts	71	71
Food products		
Value	15,650,000	17,716,000
Number contracts	119	128
Textile		
Value	10,967,000	9,977,000
Number contracts	91	70
Steel mills		
Value	5,080,000	8,121,000
Number contracts	13	13
Cement mills		
Value	18,027,000	5,712,000
Number contracts	26	14
Factories (product not named)		
Value	14,943,000	37,069,000
Number contracts	128	229
TOTAL		
Value	$78,519,000	$91,790,000
Number contracts	448	525
Other industrial		
Value	172,064,000	88,213,000
Number contracts	631	525
GRAND TOTAL		
Value	250,583,000	180,003,000
Number contracts	1,079	1,050

Patent Leather Factory—E. H. Merrill, Winchester, Mass., plans to rebuild patent leather factory at North Woburn, Mass. recently destroyed by fire. Estimated cost $1,000,000. Architect not selected.

Pottery Plant—Shenango Pottery Co., New Castle, Pa., awarded contract for a 1 and 3 story 100 x 540 and 180 x 400 ft. additions to pottery plant to The Austin Co., Union Trust Bldg., Pittsburgh, Pa. Estimated cost $50,000.

Pottery Plant—Winslow & Co. Inc., Forest Ave., Portland, Me., plans the reconstruction of pottery plant recently destroyed by fire. Estimated cost $250,000. Architect not selected.

Refinery (Cotton Seed Oil)—Globe-El Paso Oil Co., El Paso, Tex., is having plans prepared for the construction of a cotton seed oil refinery. Estimated cost $30,000. Private plans. Machinery and equipment will be required.

Refinery (Gasoline)—Amerada Petroleum Corp., Brownwood, Tex., will build a gasoline refinery by day labor. Estimated cost $125,000. Private plans. Machinery and equipment will be required.

Refinery (Gasoline)—Phillips Petroleum Co., Bartlesville, Okla., has acquired the plant of the Alamo Refining Co., at Borger, Tex. and plans extensions and improvements to increase the capacity from 2,000 to 7,500 bbl. daily. Estimated cost $150,000. Private plans. Machinery and equipment will be required.

Refinery (Oil) — American Oil Co., American Bldg., Baltimore, Md., plans a 2 story refinery for mixing and storing lubricating oils at Curtis Bay.

Refinery (Oil)—Anglo-Mexican Petroleum Co. Ltd., 65 Broadway, New York, N. Y., awarded contract for fabrication and erection of more than fifty tanks with all miscellaneous plate work in connection with proposed new refinery at Aruba, Dutch West Indies to Chicago Bridge & Iron Works, 37 West Van Buren St., Chicago, Ill.

Refinery (Oil)—Empire Refineries Co., Bartlesville, Okla., is having plans prepared for extensions and improvements to oil refinery including stills, compressors, pumps, etc. at Ponca City, Okla. Estimated cost $850,000. Private plans.

Refinery (Oil) — Humble Oil & Refining Co., Houston, Tex., will build an oil refinery, 5,000 to 6,000 bbls. daily capacity on Quintana Rd., 6 miles southwest of San Antonio, Tex. Estimated cost $300,000. Some machinery will be moved from another plant and installed and other machinery will be purchased. Work will be done by day labor.

Refinery (Oil and Gas)—Blue Bonnet Oil & Refining Co., Wickett, Tex., has acquired a site and plans the construction of an oil and gas refinery. Estimated cost $150,000. Private plans.

Refinery (Sugar)—Corn Products Refining Co., 1238 Bd. of Trade Bldg., Kansas City, Mo., awarded contract for the construction of a sugar refinery at North Kansas City, Mo. to Bedford Construction Co., 200 East Illinois St., Chicago, Ill. Estimated cost $1,000,000.

Refractory Plant—Cornhart Refractories Co., Starks Bldg., Louisville, Ky., awarded contract for a 2 story plant for the manufacture of refractory clay products at 16th and Lee Sts. to L. W. Hancock Co., Louisville Trust Bldg., Louisville, Ky. Estimated cost $150,000.

Rubber Factory—Archer Strauss Rubber Co., J. J. Sindler, Framingham, Mass., will soon award contract for a 1 and 2 story addition to rubber factory on Herbert St. Estimated cost $50,000. I. Richmond, 48 Boylston St., Boston, Mass., is architect.

Rubber Factory—Miner Rubber Co. Ltd. 483 St. Peter St., Montreal, Que., is having plans prepared for the construction of a 2 story, 60 x 120 ft. rubber factory at Granby, Que. Estimated cost $100,000. Equipment will be required.

Rubber Factory Addition—Goodyear Tire & Rubber Co. of Canada, New Toronto, Ont., had plans prepared for a 4 story, 100 x 125 ft. addition to rubber factory at Lake Shore Rd. Estimated cost $175,000. Private plans.

Silk Factory—American Glanzstoff Corp., identified with American Bemberg Co., 65 Madison Ave., New York, N. Y., awarded contracts for steel, foundation, etc. for a viscose silk factory at Happy Valley, Tenn. Estimated total cost approximately $37,500,000.

Silk Mill—U. S. Finishing Co., Sterling, Conn., awarded contract for a 1 story, 100 x 175 ft. silk mill to Pierce & Gaetz Inc., 42 Weybosset St., Providence, R. I.

Soap Factory—Huntington Laboratories, Huntington, Ind., plans addition to factory for the manufacture of liquid soaps, chemicals, etc. Estimated cost $25,000. Alexander & Brandt, 64 East Jackson Blvd., Chicago, Ill., are architects. Machinery and equipment will probably be required.

Soap and Glycerine Plant—J. S. Kirk & Co., 1232 West North Ave., Chicago, Ill., awarded contract for an 8 story, 75 x 206 ft. soap factory and 4 story, 56 x 110 ft. glycerine plant to Avery Brundage Co., 110 South Dearborn St., Chicago, Ill. Estimated cost $1,000,000.

Soap and Glycerin Plant—Lever Bros. Co., 164 Broadway, Cambridge, Mass., is receiving bids for a 5 story soap and glycerin plant. Estimated cost $40,000. C. I. Main Co., 201 Devonshire St., Boston, Mass., is engineer.

Sugar Cane Mill — Compania General de Tabacos de Filipinas, Barcelona, Spain, awarded contract for the construction of a sugar cane mill 3,300 ton cane and 380 ton unrefined sugar daily capacity at Hacienda Luisita in Providence of Tarlac, 60 miles north of Manila, P. I., to Fulton Iron Works Co., 1250 Delaware Ave., St. Louis, Mo. Estimated cost $2,000,000.

Sulphur Plant — Freeport Sulphur Co., Freeport, Tex., have just started two drilling rigs to prove up the 675 acre tract of sulphur deposits at Big Hill Dome in Jefferson County. Amount of machinery and number of plants will be decided after drilling is completed.